



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.



Philosophical Transactions

Please note: Due to an error in the print volume, the page numbering in this article may contain either page numbering skips, or page numbering repetitions, or both. However, the article content is presented in its entirety and in correct reading order.

Please click on "Next Page" (at the top of the screen) to begin viewing the article.

IX. *Tables of specific Gravities, extracted from various Authors, with some observations upon the same; communicated in a Letter to Martin Folkes Esq; President of the Royal Society, by Richard Davies M.D.*

Presented Feb. 18. ^{1747.} **T**HE manifold applications which may be made, for the purposes of Natural Philosophy, of the relations which Bodies bear to each other, by their respective Specific Gravities, engaged me some years since to collect all the experiments of this sort I could meet with in the course of my studies, and also to make several new ones of my own with the same design.

When my collection began to be somewhat considerable, I disposed the several bodies in Tables according to their species, which I found to be the most convenient method, as my tables were by this means capable of receiving additions in any part, without destroying the form of the whole: and as they were thereby easy and ready to be consulted, and well disposed for the forming of immediate comparisons between the several bodies of the same species.

But having now no farther opportunities of enlarging my collection, I hereby beg leave to recommend the prosecution of my design to others, as a subject well deserving the attention of some of the members of the *Royal Society*, to whom I therefore present these my tables: wishing they may prove of
some

some use and service to the inquisitive and philosophical part of the world. As I persuade myself they really will, when they shall be further rectified, by the omission of the croneous or uncertain experiments; when they shall be enlarged by the addition of such others, as may still be found in good authors, or which yet remain unpublished in the closets of the curious: and especially if some such gentlemen as have skill, leisure, and opportunities, shall please to supply their remaining defects, by the communication of their own observations, made upon those bodies, whose specific gravities have not as yet been carefully recorded.

*Denique cur alias aliis præstare videmus
Pondere res rebus, nihilo majore figura?
Nam, si tantundem est in Lanæ glomere, quantum
Corporis in Plumbo est, tantundum pendere par est.*
Lucret.

A short account of the Authors, from whose writings and experiments, the following Tables have been collected, with some remarks upon the experiments themselves, and the manner in which they appear to have been made.

THE antients have left but few particulars concerning the different specific gravities of bodies, tho' it is plain they were in the general sufficiently acquainted with them. It was by the knowledge of the various weights of gold and silver, that *Archimedes* is recorded to have detected the famous fraud committed in *Hiero's* crown, as *Vitruvius* has at large related in his *Architecture*, l. ix. c. 13. and it is from the same great philosopher, that we have derived the demonstration of those hydrostatical rules, by which the proportions are best to be known, of the several weights or densities of different bodies, having the same bulk or magnitude: as may be seen in his tract *De insidentibus humido*, lost in the *Greek* original, but retrieved in great measure, as it is said, from an *Arabic* translation. It was published in *Latin*, with a commentary by *Federicus Commandinus* at *Bononia* 1565, 4°, and the substance of it by *Dr. Barrow* in his *Archimedes*, printed likewise in 4° at *London* 1675.

Pliny, in the xviii. book of his *Natural History*, has set down the proportional weights of some sorts of grain, among which he says that barley is the lightest. *Levissimum ex his hordeum, raro excedit, [in singulos nimirum modios] xv libras, et faba xxii. Ponderosius*

Ponderosius far, magisque etiamnum triticum. And a little further on, *ex his generibus [frumenti scilicet] quæ Romam invehuntur, levissimum est Gallicum, atque e Chersoneso advectum: quippe non excedunt in modium vicens libras, si quis granum ipsum ponderet. Adjicit Sardum sex libras, Alexandrinum et trientes: hoc et Siculi pondus. Bæoticum totam libram addit: Africum et dodrantes. In Transpadanâ Italiâ scio vicens quinas libras farris modios pendere: circa Clusum et senas.* And the same author in his xxxiii. book, speaking of quicksilver, observes that it is the heaviest of all substances, gold only excepted. *Omnia ei innatant, præter aurum: id unum ad se trahit.* Which *Vitruvius* had also taken notice of, and had mentioned besides the weight of a known measure of it, that of four Roman *Sextarii*. *Eæ autem [guttæ nempe argenti vivi quæ inter se congruunt et una confunduntur] cum sint quatuor sextariorum mensuræ, cum expenduntur, inveniuntur esse pondo centum. Cum in aliquo vase est confusum, si supra id lapidis centenarii pondus imponitur, natat in summo: neque eum liquorem potest onere suo premere, nec elidere, nec dissipare: centenario sublato, si ibi auri scrupulum imponatur, non natabit, sed ad imum per se deprimetur. Ita non amplitudine ponderis, sed genere singularum rerum gravitatem esse, non est negandum.* *Archit.* l. vii. c. 8.

Again, *Q. Rhemnius Fannius Palæmon*, in his fragment *De ponderibus et mensuris*, has given us an observation, of the proportional gravities of Water, Oil, and Honey.

— *Libræ, ut memorant, bessem sextarius addet,
 Seu puros pendas latices, seu dona Lyæi,
 Addunt semissem Libræ labentis Olivi,
 Selibramque ferunt mellis superesse bilibri.*

That is to say, that the *Sextarius* of either water or wine weighed 20 ounces, the same measure of oil 18, and of honey 30. Their specific weights were therefore in proportion as 1.0, 0.9, and 1.5, exactly agreeable to what *Villalmandus* determined about the beginning of the last century: Yet was this author himself sensible that these were not to be look'd upon as very nice experiments.

*Hæc tamen assensu facili sunt credita nobis.
 Namque nec errantes undis labentibus amnes,
 Nec mersi puteis latices, aut fonte perenni
 Manantes, par pondus habent: non denique vina,
 Quæ campi aut colles nuperve aut ante tulere,
 Quod tibi mechanica promptum est depromere
 Musa.*

After which he proceeds to describe a good pretty instrument for the ready finding of the different specific gravities of fluids, and shews how those of solids also may be hydrostatically discovered. And so much shall suffice for what I had to mention from the antients relating to this subject: I now come to those who have written within these last hundred and fifty years.

Francis

Francis Bacon, Lord Verulam &c. in his *Historia densi et rari*, printed in the second volume of his works in folio, London 1741. p. 69. has given a table, which he calls, *Tabula coitionis et expansionis materiae per spatia in tangibilibus (quæ scilicet dotantur pondere) cum supputatione rationum in corporibus diversis*. This tract does not appear to have been published till after his death, which happened in the year 1626, but was probably written several years before; and the experiments were even as he tells us made long before that. *Hanc Tabulam multis abhinc annis confeci, atque ut memini, bona usus diligentia*. I therefore apprehend it to be the oldest table of Specific Gravities now extant. The experiments therein mentioned were not made hydrostatically, but with a cube of an ounce weight of pure Gold, as he says, to which he caused cubes of other materials to be made equal in size: as he did also two hollow ones of silver, and of equal weights, the one to be weighed empty, and the other filled with such liquid as he wanted to examine. He was himself sensible that his experiments of this sort were, notwithstanding his care, very defective, *possit proculdubio tabula multo exactior componi, videlicet tum ex pluribus, tum ex ampliore mensura: id quod ad exactas rationes plurimum facit, et omnino paranda est, cum res sit ex fundamentalibus*. From among these, notwithstanding their imperfection, as they appear to have been some of the first experiments of the sort regularly digested, and as they were besides made by so great a man, I have extracted the specific gravities of the fixed metals, which I have inserted as examples in the following tables: after reducing them to the common

form, upon the supposition that pure gold was, according to *Ghetaldus*, just 19 times as heavy as water. And this I have rather chosen to do, than to make use of his Lordship's own weight of water given in the table, which in the manner he took it could not be very exact, and which besides would not have brought out the specific gravity of pure gold more than 18 times as much; and that of the other metals in proportion. This table contains in all 78 articles.

There are also in the third volume of the same edition of his works, p. 223, *Certain experiments made by the Lord Bacon about weight in air and water*. These are truly *hydrostatical*, but very imperfect, I have not therefore inserted any of them in the following collection.

Marinus Ghetaldus, a nobleman of *Ragusa*, published in *quarto* at *Rome*, in 1603, his treatise entitled, *Promotus Archimedes, seu de variis corporum generibus gravitate et magnitudine comparatis*, wherein he has given a comparison between the specific gravities of water and eleven other different substances, from his own hydrostatical experiments made with care and exactness. These I have inserted: expressing the numbers as they stand in his own book, but I have afterwards also for uniformity reduced them to the decimal form. I have besides at the end transcribed at large the two tables of this author, in which every one of the twelve sorts of bodies he treats about is successively compared with all the others, both in weight and magnitude.

Father

Father *Johannes Baptista Villalpandus*, a Jesuit of *Cordoua* in *Spain*, in his *Apparatus Urbis et Templi Hierosolymitani*, printed in *folio* at *Rome* in 1604, exhibited a table of the proportional weights of the seven metals and some other substances, from his own experiments, made with great care as he tells us, by the means of six equal solid cubes of the fixed metals, and a hollow cubical vessel 8 times as large, for the comparing Mercury, Honey, Water, and Oil with the same. His numbers, which are inserted under his name in the following tables, were also again published afterwards by *Joh. Henr. Alstedius* in his *Encyclopædia universa*, printed in 2 vols. in *folio* at *Herborn* 1630, and by *Henry Van Etten*, in his *Mathematical recreations*, from whence they have been often transcribed into other books. *Villalpandus's* book, which is only the third volume of a work begun to be published several years before, was itself printed so soon after *Ghetaldus's*, that it is probable he either never saw that author, or not at least till after his own experiments were made.

Mr. *Edmund Gunter*, in his *Description and Use of the Sector*, printed after his death by Mr. *Samuel Foster* in 1626, having occasion to make mention of the specific weights of the several fixed metals, quoted *Ghetaldus*, and made use of his proportions, and so did also Mr. *William Oughtred*, in his *Circles of Proportion*, first published in *quarto* 1633, with this only difference, as to the form, that he changed *Ghetaldus's* unit into 210, whereby he expressed all his relations in whole numbers. It is likewise probable that *D. Henrion* took from the

same place the numbers he applied in his *Usage du Compas de Proportion*, printed at *Paris* in 1631, 8°. although he has not given them all with exactness, for the sake as it seems of using simpler vulgar fractions.

Father *Marinus Mersennus*, a *French* Minim, in his *Cogitata Physico Mathematica*, printed at *Paris* in 1644. 4°, has given from the observations of his accurate friend *Petrus Petitus*, a table of the specific gravities of the metals and some other bodies, making Gold 100, Water $5\frac{1}{3}$, and the rest in proportion. These I have reduced to the common form, and inserted under his name in the following tables. The same were afterwards made use of by Father *Francis Milliet de Chales*, Jesuit, in his *Cursus Mathematicus*, Monsieur *Ozanam*, Professor *Wolffius*, and several others. I have not seen *Petitus's* own book, but it was entitled *L' Usage ou le moyen de pratiquer par une Regle toutes les Operations du Compas de Proportion—augmentées des Tables de la Pesanteur et Grandeur des Metaux &c.* had a privilege dated in 1625. tho' it is said not to have been printed till some years after. The same Father *Mersennus* has also taken notice, in his general preface, of a table of 20 specific gravities, some time before published by Monsr. *Aleaume*, which he there sets down, but which he also observes to be very incorrect. I have not therefore inserted any of them in this collection.

Mr. *Smethwick*, one of the earliest members of the *Royal Society*, communicated to the same in *July* 1670, the weights of a cubic inch of several different substances;

substances; said to have been formerly taken by Mr. *Reynolds* in the *Tower of London*. This gentleman was the same who composed several tables relating to the price of Gold and Silver, which were published in a book entitled *The Secrets of the Goldsmith's Art*, at *London* 1676, in octavo. These weights are expressed in decimals of an *Averdupois* Pound, are carried to 8 places of figures, and seem to have been carefully and accurately collected. I have therefore in the following tables reduced them to the common form, in order to give them their proper authority with the rest. I am ignorant whether these weights were ever before printed or not, neither can I give any account, after what particular manner the experiments were made, from which they were taken. They were communicated to me from the register-books of the *Royal Society*; and I shall only observe, that the absolute weight here assigned of a cubic inch of common water does not differ more than a small fraction of a grain, from the weight of the same afterwards determined by Mr. *Ward* of *Chester*.

The *Philosophical Society*, meeting at *Oxford*, directed several experiments to be made hydrostatically by their members, concerning the specific gravities of various bodies; which being digested into a table, were by Dr. *Musgrave* communicated to the *Royal Society* the 21st day of *March* 1684. soon after which they were printed in the 169th number of the *Philosophical Transactions*. These experiments were, according to Dr. *Musgrave*, made by Mr. *Caswell* and Mr. *Walker*: they are all originals,

and esteemed some of the most accurate that are extant.

The honourable *Robert Boyle*, at the end of his *Medicina hydrostatica*, first published at *London* in 1690, 8°. subjoined a table of the specific gravities of several bodies, accurately taken from his own hydrostatical experiments. Besides which, there are also in the same tract, and in other parts of his works, several experiments of this excellent author's, which he has given occasionally, together with the uses resulting from them. To such of these in the following collection, as were taken from the table just mentioned, I have barely annexed his name, but to such of the others as occurred, I have also added the volume, page, and column, of the late *folio* edition of his works in 1744, where the same are to be found. It may be noted, that in the first edition of the *Medicina hydrostatica*, there were several errors of the press. Such of them as I could discover by calculation, I have corrected in the following pages.

There is a table published under the name of *J. C.* in the 199th number of the *Philosophical Transactions*, A°. 1693: and this is evidently a supplement to that above-mentioned of the *Philosophical Society* meeting at *Oxford*. The experiments were, according to the initials *J. C.* made by the same curious person Mr. *John Caswell*, and are therefore of the same estimation as the others.

M. Homberg, of the *Royal Academy of Sciences* at *Paris*, read a memoir in 1699, wherein he took no
tice

rice of the expansion of all substances by heat, and the contraction of the same by cold: from whence it must follow, that the specific gravities of the same bodies would constantly be found less in the summer and greater in the winter. And this he shew'd from the experiments he had made upon several fluids, both in the summer and the winter-seasons, by means of an instrument he had contrived and called an *Aerometer*, being a large phial, to which he had adjusted a long and slender stem, whereby he could to good exactness determine, when it was filled with equal bulks or quantities of the several fluids he proposed to examine. The result of his trials with this instrument he digested into a short table, which was printed in the memoirs of the *Academy* for the same year 1699. This table *John Caspar Eifenschmid* afterwards republished with several additions, in his tract *De Ponderibus et Mensuris*, printed at *Strasburg* in 1708, 8°. changing it to a more convenient form for his purpose, by reducing the different fluids therein named to the known bulk of a cubical *Paris* inch. So much of this table as I thought might be of service, I have here subjoined to the others in the following collection, but I have also made an alteration in the form, the better to fit it for general use, by omitting the absolute weights of the several bodies in summer and winter, and placing instead of them, after the name of each body a decimal number, expressing the proportion of its weight in winter to its weight in summer, supposed to be every-where represented by unity.

Sir *Isaac Newton* Knt. in his *Opticks* printed in 4°. at *London* 1704, gave a table of the specific gravities of several *diaphanous* bodies. The experiments were made by him with a view chiefly to optical enquiries, and to enable him to compare their densities with their several refractive powers : we may therefore be well assured that they were made by the great author with the most scrupulous care and exactness. The table consists of 22 articles.

John Harris D.D. in his *Lexicon Technicum*, first printed at *London* in 1704, fol. republished at large the several tables of specific gravities of the *Oxford Society* and *I. C.* from the *Philosophical Transactions*, and that of the honourable *Robert Boyle* from his *Medicina hydrostatica*, to which last he also added some experiments of his own, made as it seems with good accuracy. These are here extracted, and placed under his name in the following tables.

Mr. *John Ward* of *Chester*, in his *Young Mathematician's Guide*, first printed, as I take it in 1706, acquaints us, that he had himself for his own satisfaction, made several experiments upon the different specific gravities of various bodies ; and that he was of opinion, that he had obtained the proportion of the weight that one body bears to another of the same bulk and magnitude, as nicely as the nature of such matter, as might be contracted or brought into a lesser body (*viz.* either by drying, hammering, or otherwise) would admit of. And he has accordingly
 2 given

given us in the said book the weight of a cubic inch of 24 different substances, both in *Troy* and *Averdupois* ounces and decimal parts of an ounce; which he further assures us requir'd more charge, care, and trouble, to find out nicely, than he was at first aware of. This table appears to have been well-esteem'd, and to have had the sanction of Mr. *Cotes's* approbation, by his taking it, when reduced to the common form, into that collection which he drew up for his own hydrostatical lectures.

Roger Cotes M A. and *Plumian Professor of Astronomy and experimental Philosophy* at *Cambridge*, first giving about the year 1707 a *Course of Hydrostatical and Pneumatical Experiments*, in conjunction with Mr. *Whiston* in that University, drew up, for the use of that course, a very accurate Table of Specific Gravities, collecting from several places such experiments as he took to be most exact, and the best to be depended upon. And as the judgment of so great a man cannot but give a general reputation to such experiments as he had so selected, I have thought proper, in the following tables, to distinguish all such by the addition of the letter C, after the names of such persons from whom they first appear to have been taken, adding also the name of *Cotes* at length, to such others as I have not met with elsewhere, and which I therefore take to have been transcribed from the *memoranda* of his own experiments. This table of Mr. *Cotes's* used first to be given in *M.S.* to those who attended his lectures; but it was afterwards printed in a single sheet, relating to a *Course of Experiments* at *Cambridge*

in 1720, and since in Mr. *Cotes's Hydrostatical and Pneumatical Lectures*, when they were published at large in 8°. by his successor Dr. *Smith*, now the worthy Master of *Trinity College*. In these printed Lectures were inserted the gravities of Human Blood, its *Serum*, &c. from Dr. *Jurin*, instead of those that had before been made use of from Mr. *Boyle*.

Mr. *Francis Hawksbee*, now Clerk to the *Royal Society*, did, about the year 1710, begin, in conjunction with Mr. *Whiston*, who had then newly left the University, to give hydrostatical lectures &c. in *London*; for the purpose of which he reprinted in a thin volume in 4°, in which are the schemes of his experiments, Mr. *Cotes's* table of Specific Gravities above-mentioned. To which he added, from tryals of his own, the weights of Steel, soft, hard, and temper'd, which are printed with his name in the following Tables, as are also some other experiments, which he has since occasionally made, and communicated to me. Mr. *Cotes's* table, with the above-mention'd additions of Mr. *Hawksbee*, was afterwards again published by Dr. *Shaw*, in his *Abridgment* of Mr. *Boyle's Philosophical Works*, at *London*, 1725, 4°. vol. ii. p. 345.

John Freind M. D. at the end of his *Prælectiones Chymicæ*, printed at *London* in 1709, 8°. has published some new tables of the Specific Gravities both of solid and fluid bodies, entirely taken from his own original experiments. And as these tables contain an account of a very useful set of bodies, upon which few or no other experiments have been made: it is great
pity

pity that this truly learned and elegant writer was not more accurate in his tryals than he appears to have been. Many of his experiments having indeed been made in so lax and improper a manner, and so many errors having been committed in them, that one can not with security depend upon these tables, tho' containing otherwise facts one would so much desire to be truly informed about. I have however here inserted the several particulars of his two last tables, which immediately concern Specific Gravities, after correcting such errors in calculation as I could certainly come at : And I hope that I shall be excused for this free censure upon part of the works of a gentleman, who has so well deserved of the learned world, and acquired so just a reputation in it.

James Jurin, M. D. and several years Secretary of the *Royal Society*, gave, in N^o. 361 of the *Philosophical Transactions*, A^o. 1719, some original and very accurate experiments made by himself, upon the Specific Gravity of Human Blood, at several times during the six preceding years. These were accompanied with a very curious discourse, which has since been translated by himself, into *Latin*, and reprinted in his *Dissertationes Physico Mathematicæ*, Lond. 1732. 8^o.

This gentleman has also, in N^o. 369 of the same *Transactions*, obliged us with some very judicious and useful remarks, relating to the *caution to be used in examining the specific gravity of solids, by weighing them in water*; for want of attending to which, several sorts of bodies, such as human Cal-

culi, the substance of all woods, &c. have appeared, from their pores and small cavities filled up with air, to be considerably lighter than they really are.

John Woodward M. D. and Professor of Physic in *Gresham College*, had, as he acquaints us in several places of his works, made a great number of experiments upon the specific weights, of mineral and other fossil bodies, but which being probably contained in those of his papers which he ordered to be suppressed at his death, are thereby lost to the world, to which they would without all doubt have been very acceptable. All I have been able to pick up are a very few mentioned in the *Catalogue of the English Fossils in his Collection*, published since his decease, in 8°. at *London* 1729.

Mr. *Gabriel Fahrenheit* F. R. S. communicated, in N°. 383. of the *Philosophical Transactions*, *A Table of the Specific Gravities of 28 several substances*, from hydrostatical experiments of his own, made with great care and exactness; to which he subjoined some observations upon the manner in which his trials were performed, together with a description of the instruments in particular which he made use of to examine the gravities of Fluids. To some of his experiments which he thought required a greater nicety, he has affixed an asterisk in his table, signifying such to have been adjusted to the temperature of the air, when his Thermometers stood at the height of 48 degrees. This gentleman, who is well known by the reputation of his Mercurial Thermometers, which he made with
great

great curiosity, and which are now generally used, was in *England* in the year 1724.

Professior *Peter van Muschenbroek*, of *Utrecht*, published in his *Elementa Physicæ* at *Leyden* in 8°. 1734. a large table of Specific Gravities, which he afterwards yet somewhat further enlarged in his *Essai de Physique* in *French*, at *Leyden* 1739. 4°. This table contains almost all the preceding ones, but without the names of the authors from whom they were collected. I have among those which follow inserted, under this author's name, such experiments as I had not before met with elsewhere: making use of the *Latin* edition as the more correct, except in such articles which are only to be found in the *French*.

Mr. *John Ellicott* F. R. S. having an opportunity in the year 1745. to examine the weight of some large Diamonds, he accordingly, with the utmost care, and with exquisite assay-scales which very sensibly turned with the 200th part of a grain, took the specific gravities of 14 of those Diamonds, 4 of which came from the *Brasils*, and the other 10 from the *East Indies*. These experiments he communicated to the President of the Royal Society, who caused them to be read at one of their meetings, and afterwards published them in N°. 476. of the *Philosophical Transactions*. Among these *Brasilian* Diamonds, one was of the absolute weight of 92,425, another of 88,21; and among the *East-Indian* ones, one of 29,525 *Troy* grains. And as the size of these stones made them much

fitter for these enquiries, than any others which had probably ever before been used for the same purpose, so the known accuracy of the author, the goodness of his instruments, and the consistency of all his experiments, sufficiently shew the specific gravities he has delivered in his paper, may entirely be depended upon.

The same curious person also communicated the Specific Gravities of fine and standard Gold, published under his name in the following tables, and which were deduced from experiments he was so kind as to make on purpose at my request.

As I have just had occasion to mention Diamonds, it may possibly not be foreign to the purpose here to take some notice of the Diamond Carat weight, used among jewellers, which weight was originally the Carat or 144th part of the *Venetian* ounce, equal to 3,2 *Troy* Grains; but which is now, for want of an acknowledged standard, somewhat degenerated from its first weight. I have myself found it, upon a medium of several experiments, equal to 3,17 *Troy* Grains; and I have the rather taken notice of this weight here, because there happens to be a mistake about it, both in Dr. *Arbutnot*'s and Mr. *Dodson*'s tables, who have set down as it seems the number of Diamond Carats in a *Troy* Ounce, instead of the weight of the Diamond Carat itself. This Carat is again divided into four of its own Grains, and those into halves and quarters, commonly called the eighths and sixteenths of a Carat: and thus the largest of the Diamonds just above-mentioned, weighed, in the jewellers phrase, better than 29 Carats and almost half a Grain.

Mr *James Dodson*, in his book called *The Calculator*, printed in 8°. at *London* in 1747, has inserted a useful table of Specific Gravities, in which he has by the first initial letter of their names distinguished the several authors he has quoted: and amongst these are several new experiments marked with an *L*, which I am told were communicated from his own trials, by Mr. *Charles Labelye*, engineer, and which concern particularly the weights of several sorts of stone and other materials used in building. These I have also distinguished by an *L*. as they stand in Mr. *Dodson's* book.

Mr. *Geo. Graham*, F.R.S. made for me, at the request of a friend, some accurate trials upon the weight, of Gold and Silver, both when reported fine, and when reduced to the *English* Standard: all which I have inserted under his name in the following tables. Wherein I have besides reported some other single Experiments which I occasionally met with, from *Frederick Slare* M.D. *John Keill* of *Oxford*, M.D. *Stephen Hales* D.D. and *Edward Bayley* of *Havant* in *Hampshire*, M.D.

Richard Davies M.D. I have lastly to this Collection of Experiments added some of my own, which I endeavoured to make with as much accuracy, as the instruments I was provided with would allow of. My hydrostatical Balance was one constructed several years since by Mr. *Francis Hauksbee*, which I have constantly found to turn sensibly with half a grain: and the bodies upon which I made most of my trials, were taken from a collection of the *Materia Medica* formerly made by
Signor

Signor *Vigani*, and still preserved in the library of *Queen's College* in *Cambridge*.

TABLE I.

Of Metals.

© GOLD, fine. <i>Ward, C.</i>	19.640
A Medal esteemed to be near fine Gold	
<i>Ƴ. C.</i>	19.636
Or d'essai, ou de Coupelle. <i>Muschenbr.</i>	19.238
Fine Gold hammer'd. <i>Ellicot.</i>	19.207
D°. an ingot so accounted, and again refined with Antimony. <i>Ellicot.</i> . .	19.184
D°. the ingot itself just mention'd. <i>Ellicot.</i>	19.161
A Medal of the Royal Society, reported fine Gold. <i>Graham.</i>	19.158
A gold medal of Qu. Eliz. <i>Ƴ. C.</i>	19.125
D°. of Qu. Mary. <i>Ƴ. C.</i>	19.100
Aurum. <i>Fahrenheit.</i>	19.081
Id. <i>Ghetaldus.</i> Aurum purum. <i>Bacon</i> (ex hyp.)	19.000
A gold Coin of Alexander's. <i>Ƴ. C.</i> . . .	18.893
Gold. <i>Reynolds.</i>	18.806
Aurum. <i>Villalpandus.</i> <i>Petitus.</i>	18.750
Standard Gold (by which is understood Gold of 22 Carats, or such of which our Guineas are intended to be coined).	
<i>Ƴ. C. Ward. C.</i>	18.888
An old Jacobus. I suppose the scepter'd broad piece. <i>Harris.</i>	18.375
A Mentz gold Ducat. <i>Ƴ. C.</i>	18.261
	Aureus

Aureus Ludovicus. <i>Muschenbr.</i>	18.166
A five Guinea piece of K. James II. 1687. with an Elephant. <i>Graham.</i>	17.933
A Portuga piece of 3l. 12s. 1731. sup- posed to be nearly the same as Stand- ard. <i>Graham.</i>	17.854
Guineas, ten weighed together. <i>Davies.</i>	17.800
D°. on a mean of 7 trials upon those of different reigns. <i>Ellicot.</i>	17.726
A piece of Gold Coin of the Common- wealth. <i>Harris.</i>	17.625
Guineas two new ones. <i>Hauksbee.</i>	17.414
A Grain of Scotch Gold, such as Nature had made it. <i>Boyle V. 30. b. . . 12$\frac{2}{7}$</i>	12.286
Electrum, a British Coin. <i>J. C.</i>	12.071

☿ QUICKSILVER. <i>Mercurius crudus.</i>	
<i>Freind.</i>	14.117
Mercury Spanish. <i>Boyle V. 10. b.</i>	
Mercure sublimé 511 fois. <i>Muschenb.</i>	14.110
Quicksilver. <i>Oxford Soc.</i>	14.019
D°. <i>Ward. C. revived from the Ore.</i> <i>Boyle.</i>	14.000
Fine Mercury. <i>L.</i>	13.943
Quicksilver, another Parcel. <i>Oxf. Soc.</i>	13.593
Mercure amalgamé avec de l'Argent, affiné et sublimé 100 fois. <i>Muschenb.</i>	13.580
Mercurius. <i>Fahrenheit.</i>	13.575*
Argentum vivum. <i>Ghestaldus. 13$\frac{4}{7}$</i>	13.571
Mercure amalgamé avec de l'Or affiné, et sublime 100 fois; le même mêlé avec du Plomb; ensuite converti en poudre et revivifié. <i>Musch.</i>	13.550
	Course

Coarse Mercury. <i>L.</i>	13.512
Mercurius. <i>Petitus.</i>	13.406
Quicksilver. <i>Reynolds.</i>	13.147

LEAD. <i>Reynolds.</i>	11.856
Plumbum. <i>Villalpand.</i>	11.650
Id. <i>Ghetaldus</i> $11\frac{1}{2}$.	11.500
Id. <i>Bacon.</i>	11.459
Lead. <i>Harris.</i>	11.420
Hardest Lead. <i>L.</i>	11.356
Plumbum. <i>Fahrenheit.</i>	11.350
Lead. <i>Oxford Soc. Ward.</i>	11.345
Plumbum. <i>Petitus.</i>	11.343
Lead. <i>Harris.</i> (an ordinary Piece)	11.330
D°. <i>Cotes.</i>	11.325
Plumbum Germanicum. <i>Muschenb</i>	11.310
Cast Lead. <i>L.</i>	11.260

SILVER, fine. <i>Ward. C.</i>	11.091
A Medal of the Royal Society, reported	
fine Silver. <i>Graham.</i>	10.484
Argentum. <i>Fahrenheit.</i>	10.481
Silver. <i>Reynolds.</i>	10.432
Argentum. <i>Villalpandus.</i>	10.400
Id. <i>Ghetaldus.</i> $10\frac{1}{3}$.	10.333
Id. <i>Bacon.</i>	10.331
Id. <i>Petitus.</i>	10.219
Sterling or Standard Silver (that is, Silver 11	
oz. 2dwt. in the pound fine) A half crown	
of K. William's Coin. <i>Harris.</i>	10.750
D°. struck into money. <i>L.</i>	10.629
D°. <i>J. C. Ward. C.</i>	10.535
D°. Cast. <i>L.</i>	10.520

A new Crown-piece. 1746. LIMA
under the head. *Graham.*

10.284

♀ COPPER. <i>Reynolds.</i>	9.127
Cuprum. <i>Villalpandus.</i>	9.100
Æs. <i>Ghetaldus.</i> Rose Copper. <i>Ward.</i>	
C. Fine Copper. <i>L.</i> An old Cop- per Halfpeny, Charles II's Coin. <i>Harris.</i>	9.000
Copper in Half-pence. <i>L.</i>	8.915
Æs; Cuivre. <i>Petitus.</i>	8.875
Cuprum. <i>Bacon.</i>	8.866
Copper. <i>Oxf. Soc.</i>	8.843
Cuprum Suecicum. <i>Fabrenheit.</i>	8.834
Id. Japonense. <i>Fabrenheit.</i>	8.799
Id. Suecicum. <i>Mufschenbr.</i>	8.784
Common Copper. <i>L.</i>	8.478

BRASS. An old brass gold weight marked

xxxiii. <i>Harris.</i>	8.830
Aurichalcum. <i>Bacon.</i>	8.747
A Piece of hammer'd Brass. <i>Harris.</i>	8.660
Æs, Aitin, Calaminæ mixtum. <i>Petitus.</i>	8.437
Aurichalcum. <i>Fabrenheit.</i>	8.412
Brass hammer'd. <i>J. C.</i> Plate Brass. <i>Ward.</i>	8.349
Wrought Brass. <i>J. C.</i>	8.280
Cast Brass. <i>L.</i>	8.208
D°. <i>J. C.</i> <i>Ward.</i>	8.100
D°. <i>Cotes.</i>	8.000
Brass hammer'd. <i>Reynolds.</i>	7.950
D°. Cast. <i>Reynolds.</i>	7.905
A Piece of cast Brass. <i>Harris.</i>	7.666

♂ IRON. Ferrum. <i>Villalpandus.</i>	8.086
Id. <i>Ghetaldus.</i>	8.000
Iron, forged. <i>Reynolds.</i>	7.906
Ferrum. <i>Petitus.</i>	7.875
Id. <i>Bacon.</i>	7.837
Spanish bar Iron. <i>L.</i>	7.827
Swedish D°. <i>L.</i>	7.818
Ferrum. <i>Fahrenheit.</i>	7.817
Iron. <i>Cotes.</i>	7.645
D°. of a key. <i>J.C. Common Iron. Ward.</i>	7.643
A piece of hammer'd Iron, perhaps part Steel. <i>Harris.</i>	7.600
Iron cast. <i>Reynolds.</i>	7.520
D°. cast. <i>L.</i>	7.135
Softest cast Iron or Dutch Plates. <i>L.</i>	6.960
STEEL. <i>J. C. Ward.</i>	7.852
D°. <i>Cotes.</i>	7.850
D°. Spring Temper. <i>Hauksbee.</i>	7.809
D°. Nealed soft. <i>L.</i>	7.792
D°. Soft. <i>Hauksbee.</i>	7.738
D°. Hard. <i>Hauksbee.</i>	7.704
D°. Harden'd. <i>L.</i>	7.696
♂ TIN. <i>Reynolds.</i>	7.617
Stannum. <i>Bacon.</i>	7.520
Id. <i>Villalpandus. Freind.</i>	7.500
Etain d'Angleterre. <i>Muschenbr.</i>	7.471
Stannum. <i>Ghetaldus.</i> $7\frac{2}{3}$	7.400
Id. Provinciae Indiae Or. Malacca. <i>Fahren.</i>	7.364
Block Tin. <i>Oxf. Soc. Ward. C.</i>	7.321
Stannum Anglicanum. <i>Fahrenheit.</i>	7.313
Id.	

Id. commune. <i>Petitus.</i>	.	.	.	7.312
Id. purum. <i>Petitus.</i>	.	.	.	7.170
Block or Grain Tin. <i>L.</i>	.	.	.	7.156

Notes and Observations.

As I thought the uses that might be made of these Tables, either in business or in philosophy, would best be illustrated by a few short notes, I have therefore here occasionally inserted such observations as occurred to me, whilst I was revising them for the press: and as many of these related chiefly to the present defects of my tables, those I thought would probably be of service, to such as might hereafter take the trouble of improving or correcting them.

As the particulars contained in the Tables were extracted from different books, at different times, and at first only intended for my own private use, I was not solicitous to preserve one uniform language, but generally set down every experiment in my common-place, in the words of the author I took it from: and as I have since found, that by a translation I might sometimes happen not so justly to represent the body intended, I have upon the whole judged it best, here also to transcribe them in the same languages in which they were at first delivered.

To make experiments of this sort with a sufficient degree of accuracy requires a pretty deal of care and pains: and as in such as I have made myself, I have found great conveniency in the use of decimal weights, preferably to those of the common form,

I would also recommend the use of such to others, who shall please to employ themselves in the like enquiries. Those I have provided for myself have a *Troy Ounce* for their *integer*, and my least weight is the thousandth part of that quantity, differing consequently from the half of a *Troy Grain* only as 24 does from 25, which is inconsiderable so far as those small weights are concerned. My four smallest are respectively of 1, 2, 3 and 4 of those thousandth parts, and together make 10, or an unit of the next denomination, that of the 100th part of an ounce. I then have four others, making 1, 2, 3 and 4 100ths, and together the unit of of the next denomination, or one tenth of an ounce, and so on. By these I save the trouble of reducing the common weights to their lowest denomination in every experiment, and sometimes perhaps avoid making mistakes in that very trifling work.

Whenever two or more original writers nearly concur in their experiments upon any subject, the Gravity so deduced may be well depended upon. But where they differ remarkably it must either be imputed to the unequal gravity of the subject itself, or to some error in the tryals, which may easily happen in matters that depend on the observation of so many minute particulars. All those cases that so sensibly differ would well deserve to be re-examined.

The first Table above, that of Metals, as it is composed of the most perfect and uniform bodies in nature, seems capable of being adjusted with the greatest precision, both with relation to the pure
Metals

Metals themselves, and to the several degrees of their mixtures one with another, if experiments in all these cases were but made with a sufficient degree of accuracy.

Gold, in the experiments I have made myself, I could never find to come up to the weight assigned it in some of the former tables, and particularly those I have made upon our own coin, and some others have always remarkably fallen short of the weight assigned to the Standard in those same tables. I have inserted that trial in which I found Guineas to come out best; and I may venture to affirm, that that experiment, in particular, was made with as much accuracy as my instrument was capable of, the Pieces were all washed in soap and water, cleaned with a brush, and the air-bubbles well freed and the like. That experiment is besides abundantly confirmed since, by the exact trials lately made by Mr. *Graham* and Mr. *Ellicot*, which were performed with the greatest care; and the fine Gold also mentioned by the last was chosen and prepared with the greatest curiosity.

It may be observed, that the gold medals of *Q. Eliz.* and *Q. Mary*, quoted by *J. C.* were, without doubt, the large Sovereigns of those Queens, which were of the old Standard of *England*, or of gold appointed to be 23 carats, 3 grains and a half fine: That the *Mentz* Ducat, mentioned by the same, if it was one of those *ad Legem Imperii*, which are always in their own mints affirmed to be fine, come out considerably too light: and that the gold coin of the Commonwealth, and the pistoles of *France*, were like our present gold money of the goodness of 22 carats.

Mercury

Mercury is placed in this table among the Metals, by reason of its near agreement with those bodies in its specific gravity; tho' it otherwise so widely differs from them in most of its properties.

Brass is considerably condensed by hammering; whether Gold, Silver, and the other Metals are also condensed in like manner, hardly appears yet to have been sufficiently tried.

Of the mixed Metals, hardly any except Brass, appear to have had their specific gravities very carefully ascertained: bell-metal, princes metal, however, and some others, might deserve to be examined in that particular.

It might possibly be queried also, whether several mixed Metals do not either rarify or condense upon mixture, so as thereby to acquire a different specific gravity, than the natural law of their composition, at first seems to require.

It may lastly be observed, that the specific gravities of all the known Metals are such, as that none of them come up to 20 times the weight of common water, or fall sensibly below 7 times the same weight.

TABLE II.

Of Minerals, Semimetals, Ores, Preparations and Recrements of Metals, &c.

BISMUTH.	J.C.	.	.	.	.	9.859
D°. Cotes	.	.	.	.	.	9.700
D°. or Tinglafs.	Boyle.	.	.	.	.	9.550
						Tynglafs,

Tynglafs. <i>Reynolds</i>	7.951
Marcafita alba. <i>Fabrenheit.</i>	9.850
Mineral, Cornifh, fhining like a Marcafite.	
<i>Boyle.</i>	9.06
Calx of Lead. <i>Boyle.</i>	8.940
Spelter Solder. <i>J. C.</i>	8.362
Spelter. <i>J. C.</i>	7.065
Cinnabar common. <i>Boyle.</i>	8.020
Cinnabaris factitia. <i>Mufchenb.</i> (if not a mistake for the laft experiment)	8.200
Cinnabar native, breaking in polifh'd fur- faces like Talc. <i>Davies.</i>	7.710
D°. Persian, breaking rough. <i>Davies.</i>	7.600
D°. native. <i>Boyle.</i>	7.576
Cinnabaris nativa. <i>Mufchenb.</i>	7.300
Cinnabar native, very fparkling. <i>Boyle.</i>	7.060
D°. native from Guinea. <i>Davies.</i>	6.280
Cinnabar of Antimony. <i>Harris.</i>	7.060
D°. another piece. <i>Harris.</i>	7.043
D°. <i>Boyle.</i>	7.030
Cinnabar Antimonii. <i>Freind.</i>	6.666
Cinnabre d'Antimoine. <i>Mufchenb.</i>	6.044
Lead Ore, rich, from Cumberland. <i>Boyle.</i>	7.540
D°. <i>Boyle.</i>	7.140
The reputed Silver Ore of <i>Wales.</i> <i>J. C.</i>	7.464
The Metal thence extracted. <i>J. C.</i>	11.087.
Regulus Antimonii. Item Martis et Veneris.	
<i>Freind.</i>	7.500
Id. <i>Fabrenheit.</i>	6.622
Id. <i>Harris.</i>	6.600
Id. per fe. <i>Davies.</i>	4.500
Silver Ore, choice. <i>Boyle.</i>	7.000
D°	

D°. another piece from Saxony.	<i>Boyle.</i>	4.970
Lithargyrus Argenti.	<i>Freind.</i>	6.666
Lithargyrium Argenti.	<i>Muschenb.</i>	6.044
Id. Auri.	<i>Freind.</i>	6.316
Id. Auri.	<i>Muschenb.</i>	6.000
Minera Antimonii.	<i>Davies.</i>	5.810
Cuprum calcinatum.	<i>Freind.</i>	5.454
Glass of Antimony.	<i>Newton. C.</i>	5.280
Vitrum Antimonii.	<i>Freind.</i>	5.000
Id. per fe.	<i>Boyle.</i>	4.760
Tin Ore, choice.	<i>Boyle.</i>	5.000
D°. black, rich.	<i>Boyle.</i>	4.180
New English Tin Ore, Mr. Hubert's.	<i>Boyle.</i>	4.080
Tutty, a piece.	<i>Boyle.</i>	5.000
Tutia.	<i>Muschenb.</i>	4.615
Lapis Calaminaris.	<i>Freind. Lapis cæruleus</i>	
Namurcensis.	<i>Muschenb.</i>	5.000
Id.	<i>Boyle.</i>	4.920
Loadstone.	<i>Boyle V. 6. b.</i>	4.930
Magnes.	<i>Petitus.</i>	4.875
A good Loadstone.	<i>Harris.</i>	4.750
Marcasites, one more shining than ordinary.	<i>Boyle.</i>	4.780
A Golden Marcasite.	<i>J. C.</i>	4.589
Marcasites, from Stalbridge.	<i>Boyle.</i>	4.500
D°. Boyle.		4.450
Antimonium Hungaricum.	<i>Muschenbr.</i>	4.700
Antimony, good, and supposed to be Hun-		
garian.	<i>Boyle.</i>	4.070
D°. crude, which seemed to be very good.		
<i>Harris.</i>		4.058
	Antimonium	

Antimonium crudum. <i>Freind.</i>	4.000
Id. <i>Davies.</i>	3.980
Black Sand, commonly used on writing.	
<i>Boyle. V. 33. b.</i>	4.600
Crocus Metallorum. <i>Muschenb.</i>	4.500
Id. <i>Freind.</i>	4.444
Hæmatites. <i>Muschenbr.</i>	4.360
Id. <i>Boyle. V. 6. a.</i>	4.150
D°. English. <i>Boyle.</i>	3.760
Copper Ore, rich. <i>Boyle.</i>	4.170
D°. <i>Boyle.</i>	4.150
Copper stone. <i>Boyle.</i>	4.090
Emeri. <i>Boyle. V. 26. b.</i>	4.000
Manganese. <i>Boyle.</i>	3.530
A blew Slate with shining particles. <i>J. C.</i>	3.500
Iron Ore, a piece burnt or roasted. <i>Harris.</i>	3.333
Cerussa. <i>Item Chalybs cum Sulphure. pp.</i>	
<i>Freind.</i>	3.158
Lapis Lazuli. <i>J. C.</i>	3.054
D°. <i>Boyle. V. 6. b.</i>	3.000
D°. <i>Boyle.</i>	2.980
Gold Ore. <i>Boyle. V. 29. b.</i>	2.910
D°. not rich, brought from the East Indies.	
<i>Boyle.</i>	2.652
Another Lump of the same. <i>Boyle.</i>	2.634
A Mineral Stone, yielding 1 part in 160	
Metal. <i>J. C.</i>	2.650
The Metal thence extracted. <i>J. C.</i>	8.500.
Pyrites homogenea. <i>Fahrenheit.</i>	2.584
Black Lead. <i>Boyle. V. 27. a.</i>	1.860
Æs viride. <i>Freind.</i>	1.714
Plumbum ustum. <i>Freind.</i>	1.666

The second Table is composed of subjects no way strictly allied to each other, either by their gravities, or their other essential properties; and perhaps they might better, on that account, have been divided into different tables.

The bodies themselves are chiefly of an uncertain and heterogeneous nature; being so far as appears composed of different elements, and those also combined in various proportions, such as Sulphur and Arsenic, joined with Stone, Metal, and the like: and from these several degrees of mixture it must follow, that most of these kinds of bodies, tho' so far similar as to be called by the same names, yet must necessarily admit of a considerable latitude in their specific gravities. Many useful deductions may nevertheless be drawn from those considerations, relating to the comparative goodness &c. of such bodies.

Cinnabar native appears to be a compound of Mercury and Sulphur, with a portion of earthy or stony matter; and that which is heaviest must abound most with the Mercury. The different appearances which this body makes, would also give us a suspicion that there are other varieties in its composition, besides those just taken notice of: some sorts of Cinnabar, such as the *Hungarian*, breaking into polished planes and squares like Talc, whilst others, like the *Persian* of this table, break rough and with shining *granule* or *mica*; and that without any considerable difference in their gravities.

By the factitious Cinnabar it may be determined, what proportion of Mercury will so incorporate with Sulphur, as to make up an uniform body.

Antimony

Antimony may in like manner be considered as a composition of its Regulus and Sulphur.

The black sand used on writing is said by Mr. *Boyle* to be a rich Iron Ore: he also says that Emeri, Loadstone, and all such ponderous stones, contain some kind of metal, which he had himself separated from them. IV. 120. *a*.

The great variety of Ores of all kinds well deserve to be accurately examined, for the sake of the many conclusions that may be drawn from thence, concerning the natures of concrete bodies, and for many other purposes in Metallurgy. But I have as yet met with a very small number of experiments upon these substances. Dr. *Woodward* has indeed mentioned a great many observations of this sort which he had made, and kept exact registers of: but as they were probably among those papers which he order'd to be destroy'd at his death, we must look upon them as now lost to the world.

The Marcasites and Pyrites are very uncertain and strange kinds of bodies, their gravities are often very great: a Marcasite here taken from *Fahrenheit* was found nearly to equal the heaviest mineral Bismuth itself; and yet it is very seldom that any Metal or semimetal can be obtained in any quantity from these substances, all that is in them being usually destroyed, and carried away by their sulphur.

Black Lead is also a very odd kind of Mineral, having all the appearance of a Semimetal, and yet falling short even of the weight of common earth.

The Semimetals generally exceed in their specific gravity even the baser Metals themselves.

It may be observed, that it appears by this table, that the specific gravities of ores, including the metallic stones, are usually found to lie between 7 and 3 times the weight of water. Lead and Silver ores are the heaviest, those of Copper, Tin and Iron being considerably lighter. The Gold Ore we have an account of must be so poor as hardly to be worth taking any notice of: but we have in general too few of these experiments, to draw any certain conclusions from them.

TABLE III.

Of Gems, Chrystals, Glafs, and transparent Stones.

GRANATE, Bohemian. <i>Boyle.</i>	4.360
Granate. <i>J. C.</i>	3.978
Granati minera. <i>Boyle.</i>	3.100
A Pseudo-Topazius, being a natural pellucid, brittle, hairy stone, of a yellow colour.	
<i>Newton. C.</i>	4.270
Sapphires. <i>Davies.</i>	4.090
A Sapphire very perfect, but rather pale.	
<i>Hauksbee.</i>	4.068
Glafs, blue in sticks from Mr. Scale.	
<i>Hauksbee.</i>	3.885
D°. whitest, from Mr. Scale. <i>Hauksbee.</i>	3.380
D°. clear chrystal. <i>Cotes.</i>	3.150
D°. blue plate, old. <i>Hauksbee.</i>	3.102
D°. plate. <i>L.</i>	2.942
	D°

Do. old looking-glass plate of a light colour. <i>Hauksbee.</i>	2.888
Do. green. <i>Freind.</i>	2.857
Do. green bottle. <i>Hauksbee.</i>	2.746
Do. of a bottle. <i>Oxf. Soc.</i> It. a blue paste. <i>Hauksbee.</i>	2.666
Do. common green. <i>Hauksbee.</i>	2.620
Do. deep green old. <i>Hauksbee.</i>	2.587
Do. vulgar. <i>Newton. Ward.</i>	2.580
Vitrum Venetum. <i>Freind.</i>	1.791
An oriental Cat's-Eye, very perfect. <i>Hauksb.</i>	3.703
A Diamond, yellow, of a fine water, somewhat paler than the jonquille. <i>Hauksbee.</i>	3.666
Do. white of the second water. eau celeste. <i>Hauksbee.</i>	3.540
Do. East Indian, the heaviest of many. <i>Ellicot.</i>	3.525
Do. the lightest of many. <i>Ellicot.</i>	3.512
Do. Brasilian, the heaviest of many. <i>Ellicot.</i>	3.521
Do. the lightest of many. <i>Ellicot.</i>	3.501
Do. the mean of all his experiments. <i>Ellic.</i>	3.517
Do. <i>Newton. C.</i>	3.400
Diamond Bort, of a bluish black, with some little adhering foulness. <i>Hauksbee.</i>	3.495
A Jacinth of a fine colour, but somewhat foul. <i>Hauksbee.</i>	3.637
A Chrysolite. <i>Hauksbee.</i>	3.360
Chrystal cubic, supposed to contain lead. <i>Woodward.</i>	3.100
Chrystal from Castleton in Derbyshire, having the double refraction. <i>Hauksbee.</i>	2.724
Chrystal of Island. <i>Newton. C.</i>	2.720
ChrySTALLUM	

Chryſtallum diſdiaclaſticum.	J. C.	.	2.704
Chryſtallus de Rupe.	Fahrenheit.	.	2.669
Chryſtal rock.	J. C. Boyle III. 229. b.	.	2.659
D°. a large ſhoot.	Hauksbee.	.	2.658
D°. of the rock.	Newton. C. It.	.	
Chryſtal in the lead-mines near Works-		.	
worth.	Woodward.	.	2.650
D°. Hauksbee.	.	.	2.646
D°. pure pyramidal, ſuppoſed to contain		.	
Tin.	Woodward.	2. 5 or	2.400
Chryſtallus.	Petitus.	.	2.287
Chryſtal.	Boyle.	.	2.210
Talc, Jamaican.	Boyle.	.	3.000
D°. Venetian.	Boyle.	.	2.730
D°. J. C.	.	.	2.657
D°. Engliſh.	Woodward.	.	2.600
D°. a piece like Lapis Amianthus.	Boyle.	.	2.280
A red paſte.	J. C.	.	2.842
A Braſile pebble, foul and feather'd.	Hauksb.	.	2.755
D°. a fragment uncut.	Hauksbee.	.	2.676
D°. cut.	Hauksbee.	.	2.591
Jasper, ſpurious.	J. C.	.	2.666
A Corniſh Diamond cut.	Hauksbees	.	2.658
A Water Topaz, very perfect, but ſaid not		.	
to be Oriental.	Hauksbee.	.	2.653
Pebble pellucid.	J. C.	.	2.641
Briſtol Stone.	Davies.	.	2.640
Hyacinth, ſpurious.	J. C.	.	2.631
Selenites.	J. C.	.	2.322
D°. Newton.	.	.	2.252

As the mean gravity of Chryſtal appears, by the foregoing table, to be little more to that of water than

than as two and a half to one; it may well be suspected, that the Granate, Pseudo-Topazius, Sapphire, and such other Gemms which greatly exceed Chrystal in weight, do contain a considerable portion of some sort of Metal in their composition: as was observed of these bodies by Dr. *Woodward*, in his Method of Fossils, p. 24.

As to the white Sapphire, which is reputed by Dr. *Woodward* to be a species of Gemm intermediate between Chrystals and the Diamond in hardness, I have not yet obtained any good account of its specific gravity.

The weight of the Diamond is ascertained in No. 476. of the *Philosophical Transactions*, where it appears, that by experiments made with the greatest care, by Mr. *John Ellicot* F. R. S. with most exact instruments, and upon 14 different Diamonds, some of them very large, brought from different places, and having the greatest varieties of colour and shape possible; they were all found to agree in weight to a surprising degree of accuracy, being all somewhat above three times and a half the weight of common water.

This indeed differs very sensibly from what had been found in some former experiments, but it is hardly probable that those had been made upon Diamonds of so large a size as these: Mr. *Boyle* who found their weight less than 3 times that of common water, has himself told us in the same place, V. 83. b. that the stone he made use of only weighed about 8 grains. And tho no doubt can be made of the exactness of Sir *Isaac Newton's* experiment,

ziment, by which also the specific weight of the Diamond came out less than Mr. *Ellicot's*, yet it may well be question'd, whether Sir *Isaac* had, at the time when he made his trials, either so many or so perfect and weighty stones, as a favourable opportunity offered to this last gentleman. I shall therefore only observe, that, admitting this last to be the true specific weight of the Diamond, the refractive power of the same, in proportion to its density, should in Sir *Isaac Newton's* table be lessened from 14556 to 14071; which would still be greater than what is found in any other body; but is upon the whole more conformable to the general law of that table.

Sir *Isaac Newton* conjectured a Diamond to be an unctuous substance coagulated, and found it to have its refractive power nearly in the same proportion to its density as those of Camphire, Oyl-Olive, Lintseed Oyl, Spirit of Turpentine and Amber, which are fat sulphureous unctuous bodies: all which have their refractive powers two or three times greater in respect to their densities than the refractive powers of other substances in respect of theirs. Yet must it be allowed that a Diamond suffers no change by heat in any degree, contrary to the known property of Sulphurs; and as it is most reasonable in our Philosophy to treat such bodies as simple, in which we are not able to produce any change or separation of parts, we must therefore on that account consider a Diamond as a simple body and of the Chryselline kind.

Glass, which is a factitious concrete of Sand and Alkaline Salt, is nearly found to assume the mean gravity of Stones and Chrystals.

If,

If there is no mistake in the gravity of what Dr. *Freind* calls *Vitrum Venetum*, it differs very remarkably from all other kinds of Glass.

I do not know whether the Jasper and Hyacinth spurious of *J.C.* are to be understood as natural or artificial Gemms.

TABLE IV.
Of Stones and Earths.

Sardachates. <i>J. C.</i>	3.598
Lapis scissilis cæruleus. <i>Musschenbr.</i> (qu. if not the same experiment mentioned before pag. 447. <i>a blew slate with shining particles. J. C.</i>)	3.500
Cornelian. <i>Boyle.</i>	3.290
Do. <i>J. C.</i>	2.563
A Hone. <i>J. C.</i>	3.288
Do. to set razors on. <i>Harris.</i>	2.960
Marmor. <i>Petitus.</i> (probably some mistake in the experiment.)	3.937.
Marble. <i>Reynolds.</i>	3.026
Do. white. <i>Hauksbee.</i>	2.765
Do. white Italian, of a close texture visibly.	2.718
Do. white. <i>Boyle.</i> fine. <i>Ward. C.</i>	2.710
Do. white Italian, tried twice. <i>Oxford Soc.</i>	2.707
Do. black Italian. <i>Oxford. Soc.</i> veined. <i>L.</i>	2.704
Do. black. <i>Hauksbee,</i>	2.683
Do. Parian. <i>L.</i>	2.560
Lapis Amianthus, from Wales. <i>J. C.</i>	2.913
Turquoise, one of the old rock, very perfect. <i>Hauksbee.</i>	2.908
Turquoise Stone. <i>J. C.</i>	2.508
O o o	Lapis

Lapis Nephriticus.	J. C.	2.894
Corallium rubrum.	Freind.	2.857
Corall.	J. C.	2.689
Do. red.	Boyle V. 7. a.	2.680
Do.	Boyle.	2.630
Do. white, a fine piece.	Boyle.	2.570
Do. white, another piece.	Boyle.	2.540
Emeril Stone, a solid piece.	Hauksbee.	2.766
Paving Stone.	Reynolds.	2.708
Do. a hard sort from about Blaiden.		
	Oxf. Soc.	2.460
A Whetstone, not fine, such as cutlers use.		
	Harris.	2.740
Pellets, vulgarly called Alleys, which boys play withal.	Hauksbee.	2.711
English Pebble.	L.	2.696
Lapis Judaicus.	Boyle.	2.690
Id.	Freind.	2.500
Maidstone Rubble.	L.	2.666
Marbles, vulgarly so called, which boys play withal.	Hauksbee.	2.658
Morr Stone.	L.	2.656
Agate.	Boyle.	2.640
Do. German, for the lock of a gun.		
	Hauksbee.	2.628
Do. English.	J. C.	2.512
Lapis,	Petitus.	2.625
Flint, black, from the Thames.	Hauksbee.	2.623
Flint Stone.	L.	2.621
A round pebble-stone within a flint.		
	Harris.	2.610
East Indian blackish. Item, an English one.		
	Boyle. III. 243. a.	2.600
	Do.	

Do. <i>Oxford Soc.</i>	2.542
Corallachates. <i>J. C.</i>	2.605
Purbeck Stone. <i>L.</i>	2.601
Freestone. <i>Reynolds.</i>	2.584
Portland Stone. <i>L.</i>	2.570
Do. white for carving. <i>L.</i>	2.312
Grammatias Lapis. <i>J. C.</i>	2.515
Onyx Stone. <i>J. C.</i>	2.510
Slate Irish. <i>Boyle.</i> Lapis Hibernicus.	
<i>Davies.</i>	2.490
Wood petrified in Lough Neagh. <i>J. C.</i>	2.341
Osteocolla. <i>Boyle.</i>	2.240
Heddington Stone. <i>L.</i>	2.204
Allom Stone. <i>Boyle.</i>	2.180
Bolus Armena. <i>Freind.</i>	2.137
Hatton Stone. <i>L.</i>	2.056
Burford Stone, an old dry piece. <i>Oxford Soc.</i>	2.049
Heddington Stone, that of the soft lax kind. <i>Oxford Soc.</i>	2.029
Terra Lemnia. <i>Freind.</i>	2.000
Brick. <i>Cotes.</i>	2.000
Do. <i>Oxford Soc.</i>	1.979
A Gallipot. <i>J. C.</i>	1.928
Alabaster. <i>Ward. C.</i>	1.874
Do. <i>Oxford Soc.</i>	1.872
A spotted facitious Marble. <i>J. C.</i>	1.822
Stone Bottle. <i>Oxford Soc.</i>	1.777
A piece of a glass (perhaps glazed) coffee-dish of a brown colour. <i>Harris.</i>	1.766
Barrel Clay. <i>L.</i>	1.712
Lapis de Goa. <i>Davies.</i>	1.710
Lapis rufus Bremensis. <i>Musschenb.</i>	1.666

An Icicle broken from a Grotto (I suppose
 Stalactites) *Dr. Slare*, in *Harris*. . 1.190
 Chalk, as found by *Dr. Slare*. *Harris*. 1.079

The mean gravity of Stone appears to be to that of water as about two and a half to one, and many stones of great hardness, such as the Onyx, Turquoise, Agat, Marble, Flint &c. do not much exceed that weight. It may therefore well be doubted whether such Stones whose specific gravity comes up to near three times that of water, or even beyond it, owe their density to metalline additions; or whether they are really formed of a different species of matter, as the Diamond seems to be.

Coral by its density appears to be a stone, tho in a vegetating state: or it may possibly from some late observations, be of an animal nature.

What is called *Lapis Hibernicus*, is a soft stone containing Vitriol.

We have not many observations upon Earths: by those we have, it seems probable that they contain the same kind of matter in a lax form, of which Stones are a more solid and denser concretion.

Lapis de Goa is but a trifling composition, perhaps hardly worth retaining in the tables.

What species of body should *Alabaster* be accounted? which with a stone-like hardness, yet falls so much below other Stones, or even Earths, in gravity.

TABLE V.

Of Sulphurs and Bitumens.

SULPHUR. <i>Petitus.</i>	.	2.344
Do. a piece of roll. <i>Hauksbee.</i>	.	2.010
Do. vive. <i>Boyle.</i>	.	2.000
Do. German, very fine. <i>Boyle.</i>	.	1.980
Do. transparent, Persian. <i>Davies.</i>	.	1.950
Sulphur mineralis. <i>Freind.</i>	.	1.875
Brimstone, such as is commonly sold.		
<i>J. C.</i>	.	1.811
Do. <i>Cotes.</i>	.	1.800
Asphaltum. <i>Boyle.</i> III. 243. <i>a.</i>	.	1.400
Scotch Coal. <i>Boyle.</i> III. 243. <i>a.</i>	.	1.300
Coal, of Newcastle. <i>L.</i>	.	1.270
Do. Pit, of Staffordshire. <i>Oxford Soc.</i>	.	1.240
Jet. <i>J. C.</i>	.	1.238
Do. <i>Davies.</i>	.	1.160
Do. <i>Davies.</i>	.	1.020
Succinum citrinum. <i>Davies.</i>	.	1.110
Id. pingue. <i>J. C.</i>	.	1.087
Id. flavum (by 2 experiments). <i>Davies.</i>	.	1.080
Id. pellucidum. <i>J. C.</i>	.	1.065
Id. album, item pingue. <i>Davies.</i>	.	1.060
Amber. <i>Boyle.</i> <i>Newton.</i> <i>C.</i>	.	1.040
Fine Gunpowder. <i>Reynolds.</i>	.	0.698

Sulphur is in gravity very nearly the same as Earth, so that its purity can hardly be ascertained by its weight, unless the matter it is associated with is of a stony density.

The

The semidiaphanous *Sulphur* is a beautiful kind which I have but seldom seen: it is in lumps of the size of a small bean.

Coal, the sorts here taken notice of are considerably lighter than *Sulphur*: but there are many other kinds, and of different weights.

I take the *Gagates* or *Jet* to differ very little from the *Channel Coal*.

The different sorts of *Amber* may be observed not to differ considerably in their several gravities.

Sulphurs seem to be the lightest of all mineral bodies.

TABLE VI. Of Gums, Resins, &c.

GUM Arabic. <i>Freind.</i>	.	.	1.430
D°. <i>Newton. C.</i>	.	.	1.375
Opium. <i>Freind.</i>	.	.	1.360
Gum Tragacanth. <i>Freind.</i>	.	.	1.330
Myrrh. <i>Freind.</i>	.	.	1.250
Gum Guaiac. <i>Freind.</i>	.	.	1.224
Resina Scammonii. <i>Freind.</i>	.	.	1.200
Alocs. <i>J. C.</i> (qu. whether the resin or the wood).	.	.	1.177
Afa fætida, a very fine sample. <i>Hauksbee.</i>	.	.	1.251
D°. from <i>Dr. John Keill's Introd. ad veram Physicam.</i>	.	.	1.143
Pitch. <i>Oxford Soc. C.</i>	.	.	1.150
Thus. <i>Freind.</i>	.	.	1.071
Camphire. <i>Newton. C.</i>	.	.	0.996
Bees-wax. <i>Cotes.</i>	.	.	0.955
			Cera.

Cera. <i>Ghetaldus</i> . (ad aquam ut 95 $\frac{1}{11}$ ad 100).	0.954
Wax well freed from the honey. <i>Davies</i> .	0.938
Cera. <i>Petitus</i> .	0.937
D ^o . the same lump 2 years after. <i>Davies</i> .	0.942
Balsamus de Tolu. <i>Muschenbr.</i>	0.896
Mastic. <i>J. C.</i> (qu. whether the gum or the wood).	0.849

The bees wax in my own experiments was well freed from honey, by the boyling it in water, which probably made it lighter than it was set down in Mr. *Cotes's* Table: and the second experiment which I made two years after the first, if the difference was not owing to the difference of heat, is an instance of what I take to be a pretty general truth, that bodies become more dense and compact by rest, and that they would also be found heavier in the scale, in those cases where they do not lose weight by the evaporation of humidity.

The weights of vegetable Gums nearly correspond with those of the ligneous parts.

TABLE VII.

Of Woods, Barks &c.

COCO Shell. <i>Boyle</i> .	1.345
Bois de Gayac. <i>Muschenbr.</i>	1.337
Lignum Guaiacum. <i>Freind</i> .	1.333
Lignum Vitæ. <i>Oxf. Soc.</i>	1.327
Speckled Wood of Virginia. <i>Oxf. Soc.</i>	1.313
Cortex Guaiaci. <i>Freind</i> .	1.250
Lignum	

Lignum Nephriticum. <i>Freind.</i>	1.200
Lignum Asphaltum. <i>J. C.</i>	1.179
Ebony. <i>J. C. Item Aloes. J. C.</i>	1.177
Santalum rubrum. <i>J. C.</i>	1.128
Id. album. <i>J. C.</i>	1.041
Id. Citrinum. <i>J. C.</i>	0.809
Lignum Rhodium. <i>J. C.</i>	1.125
Radix Chinæ. <i>Freind.</i>	1.071
Dry Mahogany. <i>L.</i>	1.063
Gallæ. <i>Freind.</i>	1.034
Red wood. <i>Oxf. Soc.</i> It. Box wood. <i>Oxf.</i>	
<i>Soc. Ward. C.</i>	1.031
Log wood. <i>Oxf. Soc.</i>	0.913
Oak, dry, but of a very sound close texture.	
<i>Oxf. Soc.</i>	0.932
D ^o . tried another time. <i>Oxf. Soc.</i>	0.929
Do. sound dry. <i>Ward.</i>	0.927
Do. dry. <i>Cotes.</i>	0.925
Do. dry, English. <i>L.</i>	0.905
Oak of the outside sappy part, fell'd a year	
since. <i>Oxf. Soc.</i>	0.870
Do. <i>Reynolds.</i>	0.801
Do. very dry, almost worm-eaten. <i>Oxf.</i>	
<i>Soc.</i>	0.753
Dry Wainscot. <i>L.</i>	0.747
Beech meanly dry. <i>Oxf. Soc.</i>	0.854
Mastic (qu. if the wood or gum). <i>J. C.</i>	0.849
Ash dry about the heart. <i>Oxf. Soc.</i>	0.845
Do. dry. <i>Cotes.</i>	0.800
Do. meanly dry, and of the outside lax	
part of the tree. <i>Oxf. Soc.</i>	0.734
Elm dry. <i>L.</i>	0.800
D ^o . <i>Reynolds.</i>	0.768
D ^o .	

D°. <i>Oxf. Soc. C.</i>	0.600
Rad. <i>Gentianæ. Freind.</i>	0.300
Cortex <i>Peruvianus. Freind.</i>	0.734
Crabtree meanly dry. <i>Oxf. Soc.</i>	0.765
Yew, of a knot or root 16 years old. <i>Oxf. Soc.</i>	0.760
Maple dry. <i>Oxf. Soc. C.</i>	0.755
Plumtree dry. <i>J. C.</i>	0.663
Fir, dry yellow. <i>L.</i>	0.657
Dry white Deal. <i>L.</i>	0.569
Lignum <i>Abietin. Freind.</i>	0.555
Fir dry. <i>Cotes.</i>	0.550
D°. <i>Oxf. Soc.</i>	0.546
Walnut tree dry. <i>Oxf. Soc.</i>	0.631
Cedar dry. <i>Oxf. Soc.</i>	0.613
Juniper wood dry. <i>J. C.</i>	0.556
Sassafras wood. <i>J. C.</i>	0.482
Cork. <i>Cotes.</i>	0.240
D°. <i>J. C.</i>	0.237

Dr. *Jurin* has observed in the *Phil. Transf.* N°. 369. that the substance of all wood is specifically heavier than water, so as to sink in it, after the air is extracted from the pores and air-vessels of the wood, by placing it in warm water under the receiver of an air-pump; or if an air-pump cannot be had, by letting the wood continue some time in boiling water over a fire. The several weights therefore above given must be looked upon as the weights of the concrete bodies, in the condition they were, before the Air was either forcibly got out, or the water driven into the small hollows: and both these considerations may have their use

as notwithstanding that the specific weights of the solid particles are truly heavier than water, we shall from the weights of the bodies as they are now compounded, be enabled to make some judgment of their porosity, so far as they may be penetrable by water or other fluids.

TABLE VIII.
Of Animal Parts.

MANATI Lapis. <i>Boyle.</i>	2.860
Do. another. <i>Boyle.</i>	2.330
Do. a fragment of. <i>Boyle.</i>	2.290
Do. <i>J. C.</i> another from Jamaica. <i>Boyle.</i>	2.270
Pearl, very fine Seed, oriental. <i>Boyle. V.</i>	
12. <i>a.</i>	2.750
Do. a large one, weighing 206 grains.	
<i>Boyle V. 7. b.</i>	2.510
Murex Shell. <i>J. C.</i>	2.590
Crabs Eyes artificial. <i>Boyle.</i>	2.480
Do. native. <i>Boyle.</i>	1.890
Os ovium recens. <i>Freind.</i>	2.222
Oyster Shell. <i>J. C.</i>	2.092
Calculus humanus, just voided. <i>Davies.</i>	2.000
Do. <i>Boyle. V. 7. b.</i>	1.760
Do. <i>Boyle.</i>	1.720
Do. <i>Cotes.</i>	1.700
Do. <i>Boyle. V. 7. b.</i>	1.690
Do. <i>J. C.</i>	1.664
Do. <i>Davies.</i>	1.650
Do. <i>Boyle.</i>	1.470
Do.	

D°. <i>J. C.</i>	1.433
D°. <i>Davies.</i>	1.330
D°. <i>J. C.</i>	1.240
Rhinoceros Horn. <i>Boyle.</i>	1.990
The top part of one. <i>J. C.</i>	1.242
Ebur. <i>Freind.</i>	1.935
Ivory. <i>Boyle.</i>	1.917
D°. dry. <i>Oxford Soc. C.</i>	1.826
D°. <i>Ward.</i>	1.823
Unicorn's Horn, a piece. <i>Boyle.</i>	1.910
Cornu Cervi. <i>Freind.</i>	1.875
Ox's Horn, the top part of one. <i>J. C.</i>	1.840
Blade bone of an Ox. <i>J. C.</i>	1.656
A stone of the Bezoar kind found with four others in the intestines of a mare. <i>Edw. Bailey M.D. of Havant in Hampshire. See Philosoph. Transact. No. 481.</i>	
Bezoar stone. <i>Boyle.</i>	1.640
D°. a large one. <i>Davies.</i>	1.570
D°. being the kernel of another. <i>Boyle.</i>	
V. 8. <i>a.</i>	1.550
D°. a fine oriental one. <i>Boyle.</i>	1.530
D°. two weigh'd separately. <i>Davies.</i>	1.504
D°. <i>Cotes.</i>	1.500
D°. <i>Boyle.</i>	1.480
D°. <i>Boyle.</i>	1.340
A stone from the Gall-bladder. <i>Hales.</i>	1.220
Blood human, the globules of it. <i>Furin by calculation.</i>	1.126
D°. the Crassamentum of. <i>Furin from Experiments.</i>	1.086
D°. <i>Davies.</i>	1.084.

Do. from another Experiment.	<i>Jurin.</i>	1.082
Sanguinis humani cuticula alba.	<i>Davies.</i>	1.056
Human blood when grown cold.	<i>Jurin.</i>	1.055
The same as running immediately from the vein.	<i>Jurin.</i>	1.053
The serum of human blood.	<i>Jurin.</i>	1.030
Do. <i>Davies.</i>		1.026
Ichthyocolla.	<i>Freind.</i>	1.111
A Hen's Egg.	<i>Davies.</i>	1.090
Milk.	<i>J. C. C.</i>	1.031
Lac caprinum,	<i>Muschenbr.</i>	1.009
Lac.	<i>Freind.</i>	0.960
Urine.	<i>J. C. C.</i>	1.030
Id.	<i>Freind.</i>	1.012

Manati Lapis is said to be a stone, found in the head of the Manatee, or Sea-Cow of the *West-Indies*. See *Ray's Synopsis methodica Animalium Quadrupedum &c. Lond. 1693. 8º*. These Stones and Pearls are the heaviest of all the animal productions we are acquainted with.

Dr. *Jurin* has observed, *Phil. Trans.* No. 369. that, in examining fresh Human *Calculi* whilst they were still impregnated with Urine, he had met such as exceeded the weight of some sorts of burnt earthen ware and alabaster, and approached very near to that of brick, and the softer sort of paving stone; which I have myself also found to be true. Whereas those who have made their experiments upon such *Calculi*, as had most probably been a considerable time taken out of the bladder, and had consequently lost much of their weight, by the evaporation of the urine, with which they had at first

first been saturated, have found those Stones commonly to have been but about one half part, and some of them no more than a fourth part, heavier than an equal bulk of Water. From whence it has been too hastily concluded, that these Stones have very improperly been called by that name, as not at all approaching to the Specific Gravity of even the lightest real stones that we have any account of.

The *Calculus Humanus* and *Animal Bezoar* approach nearly to each other in their Specific Gravity.

Mr. *Boyle* has taken notice of the great difference to be found between the gravity of the true and the factitious Crabs-eyes. It is strange that the factitious should be made of such materials as can bring them so near to the mean gravity of true stones: and this consideration may deserve the attention of those, who may think that any particular dependence is to be had upon the use of these bodies in medicine.

Dr. *Furin* was the first who carefully examined the Specific Gravities of the different parts which compose Human Blood; and his experiments were performed with the greatest accuracy. It may be observed, that the Blood is, by an easy *analysis* divided into *Serum* and *Craffamentum*; and the *Craffamentum* again into the Glutinous and the Red globular parts, whose Specific Gravities are the greatest. It had before these experiments been the general received opinion, that the globules of the Blood were lighter than the Serum; and this indeed seemed to follow from Mr. *Boyle's* Experiments in his Natural History of *Human Blood*; from which he deduced the Specific Gravity of the mass itself, to be to that
of

of Water as 1040 to 1000, and that of the Serum alone to be to the same as 1190. And these numbers 1040 and 1190 had accordingly, till Dr. *Jurin* re-examined the affair, been constantly taken to represent the true gravities of Human Blood and its Serum respectively. See Dr. *Jurin's dissertation* in *Phil. Transf.* N°. 361.

Milk is made by Dr. *Freind* to fall more short of the Gravity of Water, than it is made to exceed the same by *J. C.* Possibly this difference might arise from the Milk's being taken in one case warm from the cow, and in the other after it had stood some time.

TABLE IX.

Of Salts.

MERCURIUS dulcis bis sublim.	<i>Musch.</i>	12.353
Mercurius dulcis.	<i>Freind.</i>	11.715
Id. ter sublim.	<i>Musch.</i>	9.882
Id. tertio sublim. Item Panacea rubra.		
<i>Freind.</i>		9.372
Id. quater sublim.	<i>Musch.</i> Item	
Turpethum minerale.		8.235
Id. 4to sublim. Item Turpeth mineral.		
<i>Freind.</i>		7.810
Sublimat. corrosiv.	<i>Musch.</i>	8.000
Id. <i>Freind.</i>		6.045
Cinis clavellatus, fordibus faleque suo neutro quodam (quod fere semper magis vel minus in cinere illo reperitur) depurgatus.		
<i>Fahrenheit.</i>		3.112
Sal illud neutrum.	<i>Fahrenheit.</i>	2.642
	Saccharum	

Saccharum Saturni. Item sal Nitri fix.	
<i>Muschenbr.</i>	2.745
Eadem. <i>Freind.</i>	2.600
Magisterium Coralli. Item Pulvis sympatheticus. <i>Freind.</i>	2.231
Tartarum vitriolatum. <i>Muschenbr.</i>	2.298
Id. <i>Freind.</i>	2.186
Sal mirabile Glauberi. <i>Muschenbr.</i>	2.246
Id. <i>Freind.</i>	2.132
Tartarum emeticum. <i>Muschenbr.</i>	2.246
Id. <i>Freind.</i>	2.077
Sal Gemmæ. <i>Newton. C.</i>	2.143
Nitrum. <i>Fahrenheit.</i>	2.150
Nitre. <i>Newton. C.</i>	1.900
Id. <i>Freind.</i>	1.671
Sal Guaiaci. Item Sal enixum. Item Sal prunellæ. Item S. Polychrest. <i>Musch.</i>	2.148
Eadem omnia. <i>Freind.</i>	2.030
Sal maritimum. <i>Fahrenheit.</i>	2.125
Cremor Tartari. Item Vitriol. alb. Item Vitriol. rubefact. Item S. Vitriol. <i>Musch.</i>	1.900
Cremor Tart. Item Vitriol. alb. <i>Freind.</i>	1.796
Vitriol English, a very fine piece. <i>Boyle.</i>	1.880
D°. Dantzick. <i>Newton. C.</i>	1.715
Alumen. <i>Fahrenheit.</i>	1.738
Alum. <i>Newton.</i>	1.714
Sal chalybis. <i>Freind.</i>	1.733
Borax. <i>J. C.</i>	1.720
D°. <i>Newton. C.</i>	1.714
Vitriolum viride. Item Calcanth. rubefact. Item S. Vitriol. alb. <i>Freind.</i>	1.671
Saccharum albiss. <i>Fahrenheit.</i>	1.606 $\frac{1}{2}$
Mel. <i>Villalpandus.</i>	1.500
Id. <i>Ghetaldus</i> 1 $\frac{9}{16}$. Honey, <i>Cotes.</i>	1.450
Sal	

Sal volatile Cornu Cervi. <i>Muschenb.</i>	1.496
Id. <i>Freind.</i>	1.421
Sal Ammoniac. purum. Item Ens Martis semel sublimat. <i>Muschenb.</i>	1.453
Eadem. <i>Freind.</i>	1.374
Ens Martis ter sublimat. <i>Muschenb.</i>	1.269
Id. <i>Freind.</i>	1.233

Most of the experiments in the ninth table are taken from Dr. *Freind*, who weigh'd the Salts in Spirits of Wine, and register'd the proportional gravity of the Salts to the Spirits. But the misfortune is, that the gravity of the Spirits of Wine he made use of is not register'd: so that the experiments cannot with certainty be reduced to the common standard of Water. He has deliver'd the gravity of Spirits of Wine to be 0.818, and that of Spirits of Wine rectified to be 0.78. I have supposed the Salts to be weighed in the last, as being the fittest for the purpose: but which he really used can only be conjectured.

There appears indeed to be a way to discover the weight of the Spirits of Wine, in which Dr. *Freind* weighed his Salts: for he weighed 60 Grains of Mercury, both in Water and in Spirits of Wine, and the loss of its weight was respectively $4\frac{1}{4}$ Grains and $2\frac{2}{3}$. Now the gravities of these Fluids must be in the same proportion, and this would give for the weight of the Spirits of Wine 0.627, which is much too little for the weight of his own rectified Spirits tho even that is less than what is assigned by any other author. So that, upon the whole, nothing can really be concluded from this experiment; and it must

must be allowed besides, that 60 Grains of Mercury take up too small a bulk in these Fluids, to have their gravities determined with any exactness thereby.

As Professor *Muschenbroek* has given in his table the specific weights of many of the same salts which are mentioned by Dr. *Freind*, but which differ considerably from the weights above set down, as resulting from the Doctor's experiments, I have also transcribed the Professor's numbers from his own table. These do not however appear to me to be derived from new or differing experiments, but from the very same related by Dr. *Freind*, only computed from the supposition of a heavier sort of Spirits of Wine, whose specific gravity is supposed to have been 0.823. The gravity of the *Sublimate corrosive*, set down 8.000, I take to be a mistake, made by the writing down its comparative weight to that of the Spirits themselves, instead of the water to which it should have been referred.

It requires great care and attention to take the Specific Gravities of Salts with sufficient accuracy. They dissolve in Water, and in some degree in all Fluids that partake of the nature of Water. If therefore Spirits of Wine are made use of for this purpose, they ought to be highly rectified, their own gravity accurately ascertained, and their degree of heat should be preserved uniform. For as this Fluid rarefies much faster than Water does, a small difference of heat would sensibly affect the gravities of the Salts to be determined by it. And perhaps Spirit of Turpentine were a more proper Fluid to be employed on these occasions.

It is remarkable, that *Tartar vitriolat. Sal Gem. Sal mirabile, Sal maritimum, Nitre, &c.* being Salts composed of different Acids and an Alkaline Salt, should so far exceed in gravity the Vitriolic Salts, composed of the most heavy Acid and a metallic Earth. Is not this owing to its forming less solid Chrystals, and to its containing large quantities of Air concealed in its Pores?

The great difference in the weight of the *Nitre*, in the several experiments of *Fahrenheit, Newton*, and *Freind*, may possibly be owing to the quantity of its concealed Air.

T A B. X.

Of Fluids.

MERCURY. <i>Ward. C.</i> (See Tab. I. among the Metals.)	14.000
Oleum Vitrioli. <i>Fahrenheit.</i>	1.8775*
Oyl of Vitriol. <i>Newton C</i>	1.700
Spiritus Nitri Hermeticus. <i>Freind.</i>	1.760
Id. <i>Muschenb.</i>	1.610
Lixivium cineris clavellati, sale quantum fieri potuit impregnatum. <i>Fahrenheit.</i>	1.5713*
Id. alio tempore præparatum. <i>Fahrenb.</i>	1.5634*
Oil of Tartar. <i>Cotes. Ol. Tartari per deliquium. Muschenb.</i>	1.550
Spiritus Nitri, cum Ol. Vitrioli. <i>Freind.</i>	1.440
Id. <i>Muschenb.</i>	1.338
Spiritus Nitri communis. Item, Bezoardicus. <i>Freind.</i>	1.410
	Spirit

Spirit of Nitre. <i>Cotes.</i> Item Sp. Nit.	
Bezoardicus. <i>Muschenb.</i>	1.315
Sp. Nitri. <i>Fahrenheit.</i>	1.2935*
Sp. Nitri dulcis. <i>Muschenb.</i>	1.000
Aqua fortis melioris notæ. <i>Fahrenheit.</i>	1.409*
Eadem, duplex. <i>Freind.</i>	1.340
Aqua fortis. <i>Cotes.</i>	1.300
Eadem, simplex. <i>Freind</i>	1.100
Solutio falis comm. in aqua saturata.	
<i>Davies.</i>	1.244
Eadem, 1 in aquæ 2,7 part. ponderis.	
<i>Davies.</i>	1.240
Eadem 1 in aquæ 3 part. <i>Davies.</i>	1.217
Eadem, 1 in aquæ 3 part. <i>Freind.</i>	1.146
Eadem, 1 in aquæ 12 part. <i>Davies.</i>	1.060
Soap Lees the strongest. <i>Jurin.</i>	1.200
D°. Capital. <i>Jurin.</i>	1.167
Spirit of Vitriol. <i>Freind.</i>	1.200
Spiritus Salis cum Ol. Vitriol. <i>Muschenb.</i>	1.154
Idem, &c. <i>Freind.</i>	1.146
Spirit of Salt. <i>Cotes.</i> Sp. Salis marini.	
<i>Muschenb.</i>	1.130
Sp. Salis communis. <i>Freind.</i>	1.037
Sp. Salis dulcis. <i>Muschenb.</i>	0.951
Id. <i>Freind.</i>	0.890
Sp. Salis Ammoniaci succinat. Item, cum	
ciner. clavellat. <i>Freind.</i>	1.120
Sp. Salis Ammoniac. cum calce. <i>Muschenb.</i>	0.952
Idem cum calce viva. <i>Freind.</i>	0.890
Sp. Cornu Cervi non rectific. <i>Freind.</i>	1.073
Sp. Serici. <i>Muschenb.</i>	1.145
Sp. Urinæ. <i>Cotes.</i>	1.120
Solutio Salis enixi, 1 in aquæ 5 part.	
<i>Freind.</i>	1.100
Qq q 2	Olcum

Oleum Sassafras. <i>Muschenb.</i>	1.094
Decoction Gentianæ. <i>Freind.</i>	1.080
Sp. Tartari. <i>Freind. Muschenb.</i>	1.073
Decoction Bistortæ. <i>Freind.</i>	1.073
Decoction Sarzæ. It. Chinæ. <i>Freind.</i>	1.049
Decoction Ari. It. Sp. Salis comm. <i>Freind.</i>	1.037
Oleum Cinnamomi. <i>Muschenb.</i>	1.035
Ol. Caryophyllorum. <i>Muschenb.</i>	1.034
Beer-Vinegar. <i>Oxf. Soc.</i>	1.034
Acetum Vini. <i>Muschenb.</i>	1.011
Id. distillatum. <i>Muschenb.</i>	0.994
Acetum. <i>Freind.</i>	0.976
Sack. <i>Oxf. Soc.</i>	1.033
Sp. Ambræ. <i>Muschenb.</i>	1.031
Sea-Water. <i>Cotes.</i>	1.030
D°. settled clear. <i>Oxf. Soc. Ward.</i>	1.027
College plain Ale. <i>Oxf. Soc.</i>	1.028
Solutio Aluminis, 1 in aquæ 5.33 part.	
Item Solutio Sal. Amm. purif. 1, et vitriol. alb. 1, in aquæ 5 part. <i>Freind.</i>	1.024
Laudanum liquidum Sydenhami. It. Panacea Opii. <i>Freind.</i>	1.024
Decoction Cort. Peruv. Item, Granatorum. <i>Freind.</i>	1.024
Moil Cyder, not clear. <i>Oxf. Soc.</i>	1.017
Aqua fluviatilis. <i>Muschenb.</i>	1.009
Tinctura Aloes cum aqua. Item, Decoction Sanrali rubri. <i>Freind.</i>	1.000
Rain Water. <i>Newton, Reynolds.</i> Common Water. <i>Cotes.</i> Common clear Water. <i>Ward.</i> Pump Water. <i>Oxf. Soc. J. C.</i>	
Aqua. <i>Ghetaldus.</i> Aqua pluviatilis. <i>Fahrenheit, Muschenb. &c.</i>	1.000
	Aqua

Aqua vel Vinum.	<i>Villalpandus.</i>	1.000
Aqua putealis.	<i>Muschenb.</i>	0.999
Oleum Fœniculi.	<i>Muschenb.</i>	0.997
Oleum Anethi.	<i>Muschenb.</i>	0.994
Aqua distillata.	<i>Muschenb.</i>	0.993
Wine, Claret.	<i>Oxf. Soc.</i>	0.993
D°. red.	<i>Ward.</i>	0.992
Vinum.	<i>Petitus.</i>	0.984
Id. <i>Ghetaldus.</i> (ad aquam ut 98 $\frac{1}{3}$ ad 100.)		0.983
Id. Burgundicum.	<i>Muschenb.</i>	0.953
Oleum Sabinæ. It. Hyssopi.	<i>Muschenb.</i>	0.986
Ol. Ambræ. It. Pulegii.	<i>Muschenb.</i>	0.978
Ol. Menthæ. It. Cumini.	<i>Muschenb.</i>	0.975
Decoctio Sabinæ.	<i>Freind.</i>	0.960
Infusio Marrhubii. It. Menthæ. It. Absynth.		
<i>Freind.</i>		0.950
Ol. Nucis Moschatae.	<i>Muschenb.</i>	0.948
Ol. Tanacetii.	<i>Muschenb.</i>	0.946
Ol. Origani. It. Carvi.	<i>Muschenb.</i>	0.940
Elixir Propr. cum Sale volat. It. Infusio		
Theæ.	<i>Freind.</i>	0.940
Ol. Spicæ.	<i>Muschenb.</i>	0.936
Ol. Rorismarini.	<i>Muschenb.</i>	0.934
Linseed Oyl.	<i>Newton. C.</i>	0.932
D°. <i>Ward.</i>		0.931
Spirits of Wine proof, or Brandy.	<i>Ward.</i>	0.927
Sp. of Wine well rectified.	<i>Newton. C.</i>	0.866
Alcohol Vini.	<i>Fahrenheit.</i>	0.826
Id. magis dephlegmatum.	<i>Fahrenheit.</i>	0.825
Sp. Vini.	<i>Freind.</i>	0.818
Id. rectific.	<i>Freind.</i>	0.781
Esprit de Vin etherè.	<i>Muschenb.</i>	0.732
	Spiritus	

Spiritus Croci. <i>Freind.</i>	0.925
Lamp Oyl. <i>Reynolds.</i>	0.924
Oleum. <i>Ghetaldus.</i> (ad aquam ut 91 $\frac{2}{3}$ ad 100.)	0.916
Oyl Olive. <i>Newton. C.</i>	0.913
D°. <i>Ward.</i>	0.912
Sallad Oyl. <i>Reynolds.</i>	0.904
Oleum. <i>Villalpandus.</i>	0.900
Id. <i>Petitus.</i>	0.891
Ol. Raparum. <i>Fahrenheit.</i>	0.913
Id. Ir. Tinct. Chalyb. Mynsicht. Ir. Tinct. Sulphur cum Sp. Terebynth. <i>Freind.</i>	
It. Huile de semences de navets. <i>Musch.</i>	0.853
Sp. Mellis. <i>Musch.</i>	0.895
Sp. Salis Ammoniaci cum calce viva.	0.890
Oleum Aurantiorum. <i>Musch.</i>	0.888
Spirit of Turpentine. <i>Newton. C.</i>	0.874
Tinct. Castorei. Item Sp. Vini camphorat. <i>Freind.</i>	0.870
Oyl of Turpentine. <i>Boyle V. 22. a.</i>	0.864
Ol. Terebynth. <i>Freind.</i>	0.793
Ol. Ceræ. <i>Musch.</i>	0.831
Tinctura Corallii. <i>Freind.</i>	0.828
Aqua cocta. <i>Freind.</i>	0.750
Air. <i>Newton. C.</i>	0.00125
<i>Aer Princip. Edit. 3. p. 512. Aer juxta superficiem terræ occupat quasi spatium 850 partibus majus quam aqua ejusdem ponderis.</i>	
	0.00118
<i>The same, by an experiment made by the late Mr. Francis Hauksbee F.R.S. when the barometer stood at 29.7 inches. See Physico Mathem. Exp. pag. 74.</i>	
	0.00113
	As

As to the absolute weight of water with which all the other bodies are compared in these Tables, Mr. *Boyle* tells us in his *Medicina Hydrostatica*, printed in the new Edition of his Works, V. 19. *b.* that he had found by his own experiments, that a cubic inch of clear water weighed 256 *Troy* Grains. And Mr. *Ward* of *Chester*, who afterwards pursued this affair with great accuracy, determined that a cubic inch of common clear water did weigh by his tryals 253.18 like *Troy* Grains, or 0.527458 decimals of the *Troy Ounce*, or 0.578697 of the *Ounce Averdupois*, agreeable to what Mr. *Reynolds* had formerly deliver'd, who found the inch cubic of Rain Water to weigh by his experiments 0.579036 decimals of the same *Averdupois* ounce, differing from the other only 0.000339 parts.

But, as the accuracy of all the experiments in these tables depends upon the identity of the weight of Common Water, it may not be improper to ascertain that point by a Note taken from Mr. *Boyle's Medicina Hydrostatica*, V. 18. *b.* where he expresses himself in the following manner.

—“ It speciously may, and probably will be
 “ objected, that — there may be a great disparity
 “ betwixt the liquors that are called, and that de-
 “ servedly, *Common Water*. And some travellers
 “ tell us from the press, that the water of a certain
 “ eastern river, which if I mistake not is *Ganges*,
 “ is by a fifth part lighter than our water. But—
 “ having had upon several occasions the opportunity
 “ as well as curiosity to examine the weight of
 “ divers waters, some of them taken up in places very
 “ distant

“ distant from one another. I found the difference
 “ between their specific gravities far less than almost
 “ any body would expect. And if I be not much
 “ deceived by my memory (which I must have
 “ recourse to, because I have not by me the notes
 “ I took of those trials) the difference between
 “ waters, where one would expect a notable dispa-
 “ rity, was but about the thousandth part (and
 “ sometimes perchance very far less) of the weight
 “ of either. Nor did I find any difference con-
 “ siderable in reference to our question, between
 “ the weight of divers waters of different kinds, as
 “ spring-water, river-water, rain-water, and snow-
 “ water; though this last was somewhat lighter
 “ than any of the rest. And having had the curio-
 “ sity to procure some water brought into *England*,
 “ if I much misremember not, from the river
 “ *Ganges* itself; I found it very little, if at all,
 “ lighter than some of our common waters.”

The heaviest fluid we are acquainted with, next
 to *Mercury*, is *Oyl of Vitriol*, or water impregnated
 with the *Vitriolic Acid* in the highest degree we
 can obtain it, being almost double the weight of
 Water.

The next is probably the *saturated solution* of
 the *fix'd Salt of Vegetables*; being a ponderous
 Salt, and dissolving freely in Water.

The next to this is *Spirit of Nitre*. *Spirit of*
Salt is lighter, and inferior in weight to the *satu-*
rated solution of *Salt* itself.

It is observable, that *marine* or *common Salt*
 and *Nitre* differ little in gravity, contrary to the
 nature of their *Spirits*.

The

The several *solutions* of *common Salt*, if accurately repeated, would shew in what proportion the gravities of fluids increase, upon the addition of Salt: and that *Sea-Water* does not contain one twenty-fourth part of Salt.

I have omitted in this table the three animal fluids, Milk, Serum of Blood, and Urine, as the same may be seen before in the 8th table, that of *animal parts*; but it may be noted in general that the specific gravity of all these fluids is nearly the same as that of Sea Water.

There are in Dr. *Freind's* table several decoctions of Plants, which I have inserted, altho' they are not I think of much use, nor greatly to be depended upon. Several of them are lighter than common Water, in contradiction to Dr. *Jurin's* observation, that *Vegetable Parts* are all heavier than Water: But it is probable these Experiments were made before the *Decoctions* were reduced to the temper of *Common Water*.

What is meant by the *Aqua cocta* of Dr. *Freind* in his table, I cannot imagine; not having any idea of such a change by boiling or otherwise, as can deprive common water of a full fourth part of its weight.

Since the density of the Air is as the force by which it is compressed, it follows that the weight of any portion of Air must vary in the same proportion with the weight of the whole *Atmosphere*: which in our climate is not less than one tenth of the whole weight, allowing the *Barometer* to vary from 28 to 31 Inches.

Again, by an experiment of the late Mr. *Hauksbee's* in his *Phys. Mechan. exp.* pag. 170. the density of the air varies one eighth part between the greatest degree of Heat in Summer, and that of Cold in the Winter Season. So that the Air, in a hard frost when the *Mercury* stands at 31 inches, is near a fifth part specifically heavier, than it is in a hot day when the *Mercury* stands at 28 inches.

T A B. XI.

From Monsr. Homberg and John Caspar Eifenschmid, of the proportion of the specific weights of certain fluids in the Winter to the weights of the same in the Summer Season.

Mercurius	.	.	.	1.00479
Aqua pluvialis	.	.	.	1.00809
Aqua fluviatilis	.	.	.	1.00811
Aqua distillata	.	.	.	1.00815
Spirit. Vitriol.	.	.	.	1.01272
Lac bubulum	.	.	.	1.01316
Aqua marina	.	.	.	1.01351
Spir. Salis	.	.	.	1.01467
Acetum	.	.	.	1.01600
Ol. Vitrioli	.	.	.	1.02131
Ol. Terebynth.	.	.	.	1.02141
Aqua fortis	.	.	.	1.02637
Ol. Tartari	.	.	.	1.03013
Spir. Vini	.	.	.	1.03125
Spir. Nitri	.	.	.	1.04386

The

The Oyls of Olive and sweet Almonds congealing with the cold, could not be examin'd by the *Aræometer* in the winter season.

According to this table, the increase of the specific weight of common water in the winter above its weight in the summer, is not more than about the one hundred and twenty-fourth part of the whole; which is little more than half of what Professor *Muschenbroek* has elsewhere accounted the same, *desorte qu' un pied cubique Rhenan d'Eau, qui pese environ 64 livres en Etè, se trouvera etre en Hiver de presque 65 livres. Essai de Physique p. 424.* but sure this difference is much too great.

Notwithstanding that all fluids are condensed by cold, it is only till such time as they are ready to freeze; for upon the freezing they immediately expand again, so as for the ice to be lighter specifically than the fluid of which it is formed, and to swim in it: *Muschenbroek* gives the specific weight of Ice to be to that of Water commonly as 8 to 9. *La pesanteur de la Glace est ordinairement a celle de l'Eau, comme 8 a 9. pag, 441.* I am not acquainted with any other accurate experiments upon this subject, and it is hard to get ice in which there are not large bubbles of air included.

The *Philosophical Society* at *Oxford*, together with their Table of *Specific Gravity* already so often mentioned in the foregoing pages, communicated besides at the same time, to the *Royal Society*, another Table of a grosser nature indeed, but which being printed in the same Number 169. of the *Philosophical Transactions*, and appearing to be of use for many purposes; I have thought

the same not improper to be here also transcribed.

Of the weight of a cubic foot of divers grains &c, tried in a vessel of well-season'd Oak, whose concave was an exact cubic foot.

The following bodies were poured gently into the vessel, and those in the first 12 experiments were weigh'd in scales turning with two ounces; but the last 7 were weighed in scales turning with one ounce. The pounds and ounces here mentioned are Averdupois weight.

	lb	3
1. A foot of <i>Wheat</i> (worth 6 s. a bushel).	47	8
2. <i>Wheat</i> of the best sort (worth 6 s. 4 d. a bushel). Both sorts were red <i>Lammas Wheat</i> of last year.	48	4
3. The same sort of <i>Wheat</i> measured a second time.	48	2
4. White <i>Oats</i> of the last year.	29	8
The best sort of <i>Oats</i> were 2 d in a bushel better than these.		
5. Blew <i>Pease</i> (of the last year) and much worm-eaten.	49	12
6. White <i>Pease</i> of the last year but one	50	8
7. <i>Barley</i> of the last year (the best sort sells for 1 s. 6 d. in a quarter more than this)	41	2
8. <i>Malt</i> of the last year's <i>Barley</i> , made 2 months before.	30	4
9. Field <i>Beans</i> of the last year but one.	50	8
	10.	

	lb	3
10. Wheaten Meal (unsifted).	31	0
11. Rye Meal (unsifted).	28	4
12. Pump Water.	62	8
13. Bay Salt.	54	1
14. White Sea Salt.	43	12
15. Sand.	85	4
16. Newcastle Coal.	67	12
17. Pit Coal, from <i>Wednesbury</i> 63; but this is very uncertain in the filling the interstices betwixt the greater pieces.	63	0
18. Gravel.	109	5
19. Wood Ashes.	58	5

Of the same nature is also the following account of *The difference of the weight of some Liquors upon the Tunn compared to Rain Water*, from the Experiments made formerly by Mr. *Reynolds* in the *Tower of London*, and communicated to the *Royal Society*, with his others before-mentioned, by Mr. *Smethwick*, July 7. 1670.

	lb	3	Averdupois.
Muscadine Wine was found heavier than Rain Water	11	2	
Milk	8	4	
Sherry	5	3	
Ale	5	2	
Canary Wine	3	3	
Small Beer	1	3	

White Wine was found lighter than
Rain Water

1 2

Rhenish

	℥ 3	<i>Averdupois</i> .
Rhenish Wine	1 4	
Claret	1 6	
Sallet Oyl	21 6	

The proportion given by this Author as the true one of the *Averdupois* Pound to the *Troy* Pound is, that fourteen of the former are equal to seventeen of the latter.

From whence the *Averdupois* Pound would be found equal to 6994.285, and the *Ounce* to 437.143 *Troy Grains*; which is indeed a little less than the same have since been determined by others; for Mr. *Ward* of *Chester* gives from a very nice experiment as he calls it, of his own, that one pound *Averdupois* was equal to 14 ounces 11 pennyweight and $15\frac{1}{2}$ *Troy Grains*, or to $6999\frac{1}{2}$, and consequently the ounce *Averdupois* to 437.47 of the same grains. And several Gentlemen of the *Royal Society*, who very carefully on 22 *April* 1743. examined the original standards of weights kept in the *Chamberlain's Office* of his MAJESTY'S *Exchequer*, found, upon the medium of the several trials which they made with those standards, that the *Pound Averdupois* was equal to 7000.14, and the *Ounce Averdupois* to 437.51 *Troy Grains*. *Phil. Trans* N^o. 470.

I shall conclude these papers with the two Tables from *Marinus Ghetaldus* mentioned in the beginning, which I here transcribe, with an account of some of their uses, in his own words.

*Ad comparandum inter se duodecim corporum genera,
gravitate, et magnitudine Tabella.*

	Aur.	Arg. vivum	Plumb.	Argent.	Æs	Ferum	St.	Mel	Aqua	Vinum	Cera	Oleum
Oleum	20 $\frac{8}{11}$	14 $\frac{62}{77}$	12 $\frac{6}{11}$	11 $\frac{3}{11}$	9 $\frac{9}{11}$	8 $\frac{8}{11}$	8 $\frac{4}{11}$	1 $\frac{32}{33}$	1 $\frac{1}{11}$	1 $\frac{4}{33}$	1 $\frac{5}{121}$	1
Cera	19 $\frac{19}{21}$	14 $\frac{32}{147}$	12 $\frac{1}{21}$	10 $\frac{2}{63}$	9 $\frac{9}{21}$	8 $\frac{8}{21}$	7 $\frac{89}{105}$	1 $\frac{109}{210}$	1 $\frac{1}{21}$	1 $\frac{12}{210}$	1	
Vinum	19 $\frac{19}{39}$	13 $\frac{331}{413}$	11 $\frac{41}{59}$	10 $\frac{6}{59}$	9 $\frac{9}{59}$	8 $\frac{8}{59}$	7 $\frac{31}{59}$	1 $\frac{28}{59}$	1 $\frac{1}{59}$	1		
Aqua	19	13 $\frac{4}{7}$	11 $\frac{1}{2}$	10 $\frac{1}{3}$	9	8	7 $\frac{2}{3}$	1 $\frac{9}{20}$	1			
Mel	13 $\frac{3}{29}$	9 $\frac{73}{203}$	7 $\frac{27}{29}$	7 $\frac{11}{87}$	6 $\frac{6}{29}$	5 $\frac{15}{29}$	5 $\frac{3}{29}$	1				
Stannum	2 $\frac{1}{37}$	1 $\frac{221}{259}$	1 $\frac{41}{74}$	1 $\frac{44}{111}$	1 $\frac{8}{37}$	1 $\frac{3}{37}$	1					
Ferum	2 $\frac{3}{8}$	1 $\frac{9}{36}$	1 $\frac{7}{16}$	1 $\frac{7}{24}$	1 $\frac{1}{8}$	1						
Æs	2 $\frac{1}{9}$	1 $\frac{32}{63}$	1 $\frac{5}{18}$	1 $\frac{4}{27}$	1							
Argentum	1 $\frac{26}{31}$	1 $\frac{68}{117}$	1 $\frac{7}{62}$	1								
Plumbum	1 $\frac{15}{23}$	1 $\frac{29}{161}$	1									
Arg. viv.	1 $\frac{38}{97}$	1										
Aurum	1											

Quero,

Quero, exempli gratia, quam habet rationem in gravitate plumbum ad aurum. Intelligatur plumbum, quoniam levius est auro, gravitatem habere 1, et in linea plumbi, in prima columna nominata, sub titulo auri, quærat auri gravitas, ea erit $1\frac{1}{2}\frac{5}{3}$. Plumbum igitur ad aurum rationem habebit in gravitate ut 1, ad $1\frac{1}{2}\frac{5}{3}$. Si enim sumantur duo corpora magnitudine æqualia, unum plumbeum alterum aureum, sit autem plumbei corporis gravitas 1, aurei erit $1\frac{1}{2}\frac{5}{3}$; quare corpus plumbeum ad corpus aureum ejusdem magnitudinis rationem habebit in gravitate ut 1, ad $1\frac{1}{2}\frac{5}{3}$. Comparantur autem inter se genera diversa gravitate, in corporibus magnitudine æqualibus.

Rursus, quero quam habet rationem in gravitate aqua ad argentum vivum. Intelligatur aqua, ut levior argento vivo gravitatem habere 1, et in linea aquæ, sub titulo argenti vivi, quærat argenti vivi gravitas, ea erit $13\frac{4}{7}$; aqua igitur ad argentum vivum rationem habebit in gravitate ut 1, ad $13\frac{4}{7}$.

Contra, quero quomodo se habent in magnitudine aurum et plumbum. Intelligatur aurum, quoniam gravius est plumbo, magnitudinem habere 1, et in linea plumbi, sub titulo auri, quærat plumbi magnitudo, ea erit $1\frac{1}{2}\frac{5}{3}$; aurum igitur ad plumbum se habebit in magnitudine ut 1, ad $1\frac{1}{2}\frac{5}{3}$: si enim sumantur duo corpora æque gravia, unum aureum, alterum plumbeum, sit autem corporis aurei magnitudo 1, plumbei erit $1\frac{1}{2}\frac{5}{3}$; quare corpus aureum ad corpus plumbeum ejusdem gravitatis se habebit in magnitudine ut 1, ad $1\frac{1}{2}\frac{5}{3}$. Comparantur autem inter se genera diversa magnitudine, in corporibus æque gravibus.

Quero

Quæro denique, quomodo se habent in magnitudine ferrum, et aqua, ponatur ferrum, ut gravius aqua, magnitudinem habere 1, et in linea aquæ, sub titulo ferri, quæraturs aquæ magnitudo, ea erit 8, ferrum igitur ad aquam se habebit in magnitudine ut 1, ad 8.

Altera,

Altera, ad comparandum inter se duodecim corporum genera, gravitate, et magnitudine, Tabella.

	Oleum	Cera	Vinum	Aqua	Aëre	Ferrum	Argent.	Plumb.	Argent.	Plumb.	Aëre	Aqua	100
Aurum	$4\frac{3}{7}$	$5\frac{5}{100}$	$5\frac{1}{7}$	$5\frac{1}{9}$	$7\frac{1}{3}$	$42\frac{18}{100}$	$38\frac{18}{100}$	$42\frac{18}{100}$	$54\frac{3}{7}$	$60\frac{18}{100}$	$71\frac{3}{7}$	100	
Arg. viv.	$6\frac{3}{7}$	$7\frac{7}{100}$	$7\frac{1}{7}$	$7\frac{1}{9}$	$10\frac{1}{3}$	$58\frac{18}{100}$	$54\frac{18}{100}$	$66\frac{1}{10}$	$76\frac{8}{7}$	$84\frac{1}{10}$	100		
Plumbum	$7\frac{6}{7}$	$8\frac{7}{100}$	$8\frac{8}{100}$	$8\frac{1}{9}$	$12\frac{1}{3}$	$69\frac{18}{100}$	$64\frac{18}{100}$	$78\frac{9}{10}$	$89\frac{18}{100}$	100			
Argent.	$8\frac{3}{7}$	$9\frac{8}{100}$	$9\frac{1}{7}$	$9\frac{1}{9}$	$14\frac{1}{3}$	$77\frac{18}{100}$	$71\frac{18}{100}$	$87\frac{3}{10}$	100				
Æs	$10\frac{1}{7}$	$10\frac{3}{100}$	$10\frac{1}{7}$	11	$16\frac{1}{9}$	$88\frac{18}{100}$	$82\frac{9}{10}$	100					
Ferrum	$11\frac{1}{4}$	$11\frac{1}{44}$	$12\frac{7}{24}$	$12\frac{1}{2}$	$18\frac{1}{3}$	$92\frac{1}{10}$	100						
Stannum	$12\frac{4}{11}$	$12\frac{3}{11}$	$13\frac{3}{11}$	$13\frac{1}{9}$	$19\frac{3}{7}$	100							
Mel	$63\frac{19}{87}$	$65\frac{3}{100}$	$67\frac{1}{87}$	$68\frac{2}{100}$	100								
Aqua	$91\frac{2}{3}$	$95\frac{5}{11}$	$98\frac{1}{3}$	100									
Vinum	$93\frac{1}{3}$	$97\frac{4}{100}$	100										
Cera	$96\frac{2}{100}$	100											
Oleum	100												

Quæro exempli gratia, quænam sit ratio in gravitate, auri ad argentum. Intelligatur aurum quoniam gravius est argento, gravitatem habere 100, et in linea auri, sub titulo argenti, reperietur argenti gravitas $54\frac{2}{3}$, aurum igitur ad argentum rationem habebit in gravitate ut 100, ad $54\frac{2}{3}$. Si enim sumantur duo corpora, magnitudine equalia, unum aureum, alterum argenteum, sit autem aurei corporis gravitas 100, erit argentei $54\frac{2}{3}$; quare corpus aureum ad corpus argenteum ejusdem magnitudinis, rationem habebit in gravitate, ut 100, ad $54\frac{2}{3}$.

Quæro, quomodo se habet in gravitate aqua ad vinum; quoniam aqua gravior est vino, intelligatur ejus gravitas 100, et quoniam in linea aquæ, sub titulo vini, datur vini gravitas $98\frac{1}{3}$, aqua ad vinum se habebit in gravitate, ut 100, ad $98\frac{1}{3}$.

Contra quæro quomodo se habent in magnitudine argentum, et aurum. Intelligatur argentum ut levius auro, magnitudinem habere 100, et in linea auri, sub titulo argenti, queratur auri magnitudo, ea erit $54\frac{2}{3}$, argentum igitur ad aurum se habebit in magnitudine, ut 100, ad $54\frac{2}{3}$. Si enim sumantur duo corpora æque gravia, unum argenteum, alterum aureum, sit autem argentei corporis magnitudo 100, erit aurei $54\frac{2}{3}$; quare corpus argenteum, ad corpus aureum ejusdem gravitatis, se habebit in magnitudine, ut 100, ad $54\frac{2}{3}$.

Quæro denique, quomodo se habent in magnitudine aqua et argentum vivum. Quoniam aqua levior est argento vivo, intelligatur ejus magnitudo 100, et in linea argenti vivi, sub titulo aquæ, queratur argenti vivi magnitudo, et reperietur $7\frac{1}{7}$, aqua igitur ad argentum vivum se habebit in magnitudine, ut 100, ad $7\frac{1}{7}$.

F I N I S.